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611th Civil Engineer Squadron

Tin City
Long Range Radar Station, Alaska

Final Remedial Investigation/Feasibility Study

Volume I

April 30, 1996

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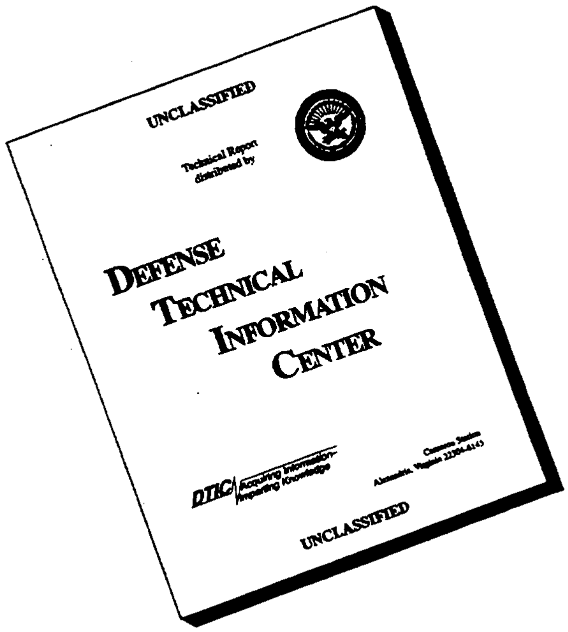

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Tin City
Long Range Radar Station, Alaska
Final Remedial Investigation/Feasibility Study
Volume I
April 30, 1996

Prepared for
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Prepared by
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This Final Remedial Investigation/Feasibility Study describes the work performed; explains project objectives; and presents data collected during project activities, results, and conclusions for the Installation Restoration Program at Tin City Long Range Radar Station, Alaska. The report describes the risks posed by the site and gives the basis for selecting remedies to mitigate the risks.

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NOTICE

This Final Remedial Investigation/Feasibility Study (RI/FS) has been prepared for the United States Air Force by EA Engineering Science and Technology, Inc. and Montgomery Watson for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP). As the Final RI/FS relates to actual or possible releases of potentially hazardous substances, its release prior to an Air Force final decision on remedial action may be in the public's interest. The limited objectives of this Final RI/FS and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this Final RI/FS since subsequent facts may become known that may make this Final RI/FS premature or inaccurate. Acceptance of this Final RI/FS in performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

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AAC	Alaska Air Command
AAS	Atomic Absorbence Spectroscopy
ABS	Alaska Biological Research, Inc.
ac	Acre
ACB	Ambient Conditions Blank
ACCI	ACCI, Inc.
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish & Game
ADNR	Alaska Department of Natural Resources
AFCEE	Air Force Center for Environmental Excellence
AFS	Air Force Station
AMNWR	Alaska Maritime National Wildlife Reserve
ANCSA	Alaska Native Claims Settlement Act
AOC	Areas of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing Materials
ATSDR	Agency of Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
BCF	Bioconcentration Factor
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CCVS	Continuing Calibration Verification Standard
CEOS	Civil Engineering Operations Squadron
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CF	Calibration Factor
cfs	Cubic Feet Per Second
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COPC	Chemicals of Potential Concern
COPEC	Contaminants Of Potential Ecological Concern
COR	Contracting Officer's Representative
cm	centimeter
CRP	Community Relations Plan
CSM	Conceptual Site Model
DCR	Dispersion by Chemical Reaction
DCR	Dispersion by Chemical Reaction
DERA	Defense Environmental Restoration Account
DO	Dissolved Oxygen
DOD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objective
DTIC	Defense Technical Information Center
EA	EA Engineering, Science, and Technology, Inc.
ESA	Endangered Species Act

EI	Exposure Intake
ELISA	Enzyme Linked Immuno-Sorbent Assay
EPC	Exposure Point Concentration
EPH	Extractable Petroleum Hydrocarbons
ES	Engineering-Science
eV	Electron-Volt
FAA	Federal Aviation Administration
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Feet
FTL	Field Team Leader
gal	Gallon
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectroscopy
GE	GE Government Services, Inc.
gpm	Gallons Per Minute
ha	Hectare
HARM	Hazard Assessment Rating Methodology
HEAST	Health Effects Assessment Summary Tables
HMTA	Hazardous Materials Transportation Act
HQ	Hazard Quotient
HRA	Health Risk Assessment
HRS	Hazard Ranking System
HSP	Health and Safety Plan
IAG	Interagency Agreements
ICP/AES	Inductively Coupled Plasma/Atomic Emission Spectroscopy
IDW	Investigative-Derived Waste
IF	Intake Factor
IRA	Interim Remedial Action
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
ITIR	Informal Technical Information Report
JSS	Joint Surveillance System
LCS	Laboratory Control Sample
LEC	Lowest Effect Concentration
LIMS	Laboratory Information Management System
LOAEL	Lowest Observable Adverse Effects Level
LOEL	Lowest Observable Effects Level
LRRS	Long Range Radar Station
LTT	Long Tramway Terminal
m	Meter
m^3	Cubic Meter
mg	Milligram
MAP	Management Action Plan
MDL	Method Detection Limit
mg/kg	Milligrams per Kilogram (parts per million)

mg/L	Milligrams per Liter (parts per million)
mph	Miles per Hour
MRL	Method Reporting Limit
MS	Matrix Spike
MSA	Method of Standard Additions
MSD	Matrix Spike Duplicate
N/A	Not Applicable
NBS	National Bureau of Standards
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFRAP	No Further Response Action Planned
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observable Adverse Effects Level
NOEL	No Observable Effects Level
NPL	National Priorities List
NR	Nonconformance Record
NTU	Nephelometric Turbidity Units
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyls
PEF	Particulate Emission Factor
PE	Performance Evaluation
PHS	Public Health Service
PID	Photoionization Detector
PLO	Public Land Order
POC	Point of Contact
POL	Petroleum, Oil, Lubricants
ppb	Parts Per Billion
PPE	Personal Protective Equipment
ppm	Parts Per Million
PQL	Practical Quantitation Limit
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAO	Quality Assurance Objectives
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Services Manager
RAS	Routine Analytical Services
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RF	Response Factor
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure

ROD	Record of Decision
RTECS	Registry of Toxic Effects of Chemical Substances
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SAS	Special Analytical Services
SF	Slope Factor
SI	Site Investigation
SOW	Statement of Work
SRM	Standard Reference Materials
SW	Solid Waste
TAL	Target Analyte List
TC	Toxicity Characteristic
TCL	Target Compound List
TDLo	Toxic Dose Low
TOC	Top of Casing
TOC	Total Organic Compound
TPH	Total Petroleum Hydrocarbons
TSD	Technical Support Document
TSDF	Treatment, Storage, and Disposal Facility
UCL	Upper Confidence Limit
ug/kg	Micrograms per Kilogram (parts per billion)
ug/L	Micrograms per Liter (parts per billion)
UF	Uncertainty Factor
USAF	United States Air Force
USBM	United States Bureau of Mines
USCS	Uniform Soil Classification System
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VF	Volatilization Factor
VOC	Volatile Organic Compounds
Vp	Volatilization Potential
VPH	Volatile Petroleum Hydrocarbons
WACS	White Alice Communications Station
WCC	Woodward-Clyde Consultants

EXECUTIVE SUMMARY

As shown on Figures 1-1 and 1-2, Tin City LRRS is located near the western tip of the Seward Peninsula on the Bering Sea. The Tin City LRRS is currently an active USAF Station and the long-term plan is for it to remain active indefinitely. Estimated current year-round staffing is four persons on average at Tin City LRRS, and no children are present on the site. In addition to the USAF staff, Richard Lee, the civilian trading post operator, resides in the abandoned community of Tin City. The surrounding area is sparsely inhabited and accessible to non-local inhabitants only by airplane or boat. A small road through the mountains and wilderness leads from the small Native village of Wales to Tin City LRRS. Residents of Wales periodically go to the Trading Post for provisions.

The area experiences a harsh, cold climate that results in the ground surface being frozen or snow covered for six to eight months of each year. The geologic features exposed at the installation are shallow bedrock consisting of granite and limestone, and unconsolidated surficial sediments. Tundra vegetation is sparsely distributed at the Airstrip and Beach areas.

Tin City is adjacent to the offshore Alaska Maritime National Wildlife Reserve (AMNWR).

The surface of the facility is drained by four creeks, all of which discharge into the Bering Sea. It appears that no direct human use of surface water is occurring at the facility. Little information is available on subsurface water at the installation. The base water supply is obtained from a well located north and topographically uphill from most of the facility. The Beach, Lower Camp, and Airstrip are topographically downgradient of the water supply wells. The Top Camp and White Alice sites are topographically upgradient, but as shown in Figures 1-2 and 1-6, are over a mile away from the water supply wells and, due to the topography in the area (Figure 1-2) are unlikely to drain toward the wells.

Several phases of IRP work have been completed at the Tin City LRRS, beginning in 1985 with a Phase I records search. Previous IRP work has led to closure of the following nine IRP sources:

- DP 08, Dump No. 1
- DT 05, White Alice PCB/POL
- LF 02, Landfill (to be addressed as a third party site)
- LF 09, Dump No. 2
- LF 10, Mid-Mountain Dump
- SD 04, Runway Oiling
- SS 01, Waste Accumulation Area
- SS 06, Spill/Leak No. 1
- SS 07, Spill/Leak No. 2

The 1995 field investigation conducted from July 10 through July 21, 1995, addressed the following seven additional IRP Sources and AOC:

- DP 011, Dump #3 at Beach
- ST 12, Four USTs (one previously closed)
- SS 13, Spill/Leak #3 at Lower Tramway Terminal (LTT)
- SS 14, Spill/Leak #4 near Bldg. 110
- AOC 1, Spill/Leak #5 at Bldg. 123, POL Pump House
- AOC 2, Fuel tanks at Top Camp substation
- AOC 3, Substation at Lower Camp

For convenience, some of the IRP Source Areas and AOC were broken down into subsets for the investigation, based on the expected source of the contamination, the chemical constituents/ contaminants and potential receptors. Table 1-1 shows a summary of the activities performed at each IRP Source Area and AOC investigated during the 1995 remedial investigation.

The predominant contaminant was petroleum. Polychlorinated biphenyls (PCBs) were detected in isolated areas of SS 13, AOC 2, and AOC 3 at levels comparable to residential cleanup levels. Elevated background levels of metals were present at the site.

At isolated sampling locations, arsenic, cadmium, chromium, lead and selenium were detected in some samples from the site. In some cases, the concentrations elevated risk levels above the commonly accepted benchmarks of 1.0E-4 to 1.0E-6 for carcinogens and 1.0 for non-carcinogens. However, in all cases, the levels were comparable to documented site background levels. Elevated concentrations of metals are not surprising since the Tin City LRRS is adjacent to many tin and platinum mining claims and elevated levels of metals are expected in mining areas. The USAF did not participate in mining activities in the vicinity of Tin City LRRS.

In August 1995 after the RI/FS field investigation, a drum removal action was performed as an Interim Remedial Action (IRA) under IRP to remove all abandoned drums, USTs, and their contents from the beach area and adjacent uphill areas. After the removal, soil samples were collected and analyzed by another Air Force contractor (ACCI, Inc.). The results have been incorporated into this report.

In all cases, no ongoing sources of releases to the environment were evident. With the removal of the abandoned drums, USTs, and their contents, all potential sources associated with these IRP Source Areas and AOC have been removed.

Based on the results of the RI/FS, the response actions are:

No further remedial action planned (NFRAP):

- SS 13 (both a and b), the Spill/Leak #3
- SS 14 (both a and b), 3 UST and AST #10
- AOC 1, Spill/Leak #5 at the Fuel Pump House, Bldg. 123

- AOC 2, Fuel tanks at Top Camp substation
- AOC 3, Substation at Lower Camp

Sites in this category consist of areas where minimal amounts of contamination were detected and the levels of contamination were comparable to background or selected regulatory benchmarks. In the case of petroleum contamination, the sites are either below the site-specific ADEC cleanup matrix levels or site-specific factors were documented that minimize the risk to human health and the environment. In all cases of petroleum contamination, the levels of identifiable SVOC and VOC were minimal and the common risk drivers, benzene and naphthalene, were either not present or were very low with respect to the detection limit. All petroleum contamination appeared quite weathered, and the absence of identifiable chemical constituents suggests that natural attenuation is proceeding and will likely continue.

Remedial Action

- ST 12, four USTs (one previously closed; no further action recommended for two additional tanks based on the results of the 1995 investigation)

- DP 011b, Dump No. 3 at the beach (no further action recommended for a portion of DP 011a, the ponded surface water and sediments)

ST 12c: Remedial action is recommended for ST 12 (UST #16 only) for the gravel pad contaminated with petroleum, because of the evidence that water-soluble petroleum constituents are migrating from the pad into the adjacent tundra in two distinct areas. The gravel pad was previously used for storing excess snow. At breakup, the snow melted and migrated through the pad, causing a driving force for the migration of petroleum constituents. The snow storage area was moved to an uncontaminated site and is expected to arrest the migration of petroleum from the pad during unfrozen months to determine whether the action is sufficient to halt the migration into the tundra. Horizontal bioventing or intrinsic remediation will be pursued for the remaining hydrocarbons. Background samples of peat and tundra exhibited elevated levels of total petroleum hydrocarbon (TPH)-diesel range due to the presence of naturally-occurring organics.

DP 011b: Soils under seven of the nine areas where abandoned drums were removed in the 1995 appear to be significantly stained, and the petroleum products still appear viscous, sticky, and tacky. The analytical results show few identifiable SVOC and VOC, however, the levels of TPH-residual and diesel range are often quite high. The risk assessment shows the risk due to detectable compounds to be below the EPA threshold of 1.0E-6. However, the high laboratory detection limits restrict the conclusions of the risk assessment on the non-detected compounds to showing only that the risk to human health is below 1.74E-4, and that the majority of risk is attributable to dermal contact with soils.

The area, located in the tundra, is typical wildlife habitat. Past experience has shown that the tacky hydrocarbons will sometimes be entrained on the feet, fur, or feathers of wildlife that come in contact with the surface soils, although little conclusive evidence on the impact of highly weathered, residual range petroleum hydrocarbons on wildlife is available.

The selected remedial action is to excavate stained soils, mix the excavated soils with clean gravel, and use the soil/gravel mixture for on-site road and/or runway maintenance. The excavated areas will be backfilled with clean fill.

1.0 INTRODUCTION

1.1 THE AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the USAF IRP program is to assess past activities at USAF installations and to develop remedial actions consistent with the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) for those sites which pose a threat to human health and/or the environment. Over the years, the IRP was developed to ensure Department of Defense (DOD) compliance with federal laws such as the Resource Conservation and Recovery Act (RCRA), CERCLA, and SARA. Executive Order 12316, executed in 1981, gave various federal agencies, including the DOD, the responsibility to act as lead agencies to conduct investigations and implement remedial efforts when they are the sole or co-contributor to the contamination on or off DOD property.

The IRP objectives are to:

- identify and evaluate sites where contamination may be present on DOD property because of past hazardous waste disposal practices or spills;
- control the migration of hazardous contaminants; and
- control health hazards or hazards to the environment that may result from past DOD operations.

The IRP was also developed to meet Applicable or Relevant and Appropriate Requirements (ARARs), be technically feasible to implement, and be cost effective. With the ultimate goal of site cleanup and closure, IRP follows a four-step remedial action process, similar to that of the USEPA. The four steps include the following:

- **Preliminary Assessment/Site Investigation (PA/SI)** is the process in which records are reviewed, sites are inspected, and interviews are conducted to identify sites where hazardous substances may have been released. Some testing may be done to determine if more investigation is required.
- **Remedial Investigation/Feasibility Study (RI/FS)** is the process in which sites are investigated to determine the nature and extent of contamination (and thus any threat to human health or the environment). A risk assessment (RA) is done to verify complete exposure pathways and estimate contaminant levels that protect human and ecological receptors (identifying the need to remediate and appropriate remediation requirements). During the FS, the appropriate method for remediating a site is identified and selected.
- **Remedial Design/Remedial Action (RD/RA)** is the process of designing and implementing the selected remedial method/alternative. Included in this process is the long-term monitoring and verification to assess the effectiveness of remediation.

- **Site Closure** is the process in which the regulating authority, in this case ADEC, verifies that a site is no longer a threat to human health or the environment.

The work at Tin City LRRS, Alaska, was accomplished according to the processes outlined above.

1.2 INSTALLATION DESCRIPTION

This section summarizes general site setting information gathered for the Tin City LRRS area from previous IRP reports and the September 1994 field visit at the installation. The site is a remote installation built on rocky ground on the coast of the Bering Sea. Tundra vegetation is present in some portions of the installation.

The installation can be divided into three distinct areas based on geologic and hydrogeologic characteristics. The three areas are:

- the Beach;
- the Lower Camp, Tramway, Top Camp and Substation; and
- the Airstrip.

The Beach area is typified by unconsolidated beach sediments, extensive shallow surface water which occurs as ponds and seeps, and tundra vegetation. The Lower Camp, Tramway, Top Camp, and Substation areas are typified by steep rocky slopes, thin soil cover, little surface water and the absence of a shallow aquifer. The Airstrip area is typified by relatively level ground with unconsolidated sediments over limestone bedrock with seasonal surface water seeps. The Airstrip itself is vegetated by tundra while the Weather Station building sits on a gravel pad.

The IRP Source Areas and AOC addressed during this RI/FS are located in these three general areas.

1.2.1 Physiography

As shown in Figures 1-1 and 1-2, Tin City LRRS is located near the western tip of the Seward Peninsula on the Bering Sea. The elevation of the land surface at the site ranges from sea level at the beach to 2,289 feet (697.7 m) at the top of Cape Mountain. The Lower Camp Tramway and Top Camp areas of Tin City LRRS are located on the steep, mostly barren, granitic slopes of Cape Mountain. The slopes of the mountain are cut by creek drainages, the largest of which is Cape Creek.

East of Cape Creek, the land surface is gently sloping, almost level in some areas, at an elevation of approximately 250 feet (76.2 m). The Airstrip area is located on this relatively level area.

The Beach Area is a low-lying, mostly level area on the Bering Sea. The beach has a low natural berm with surface water ponded on the landward side of the berm. The Beach Area includes the former Tin City townsite, located near the mouth of Cape Creek. Tin City LRRS facilities at the beach include the foundation of a formerly used Fuel Transfer Station, the Dump No. 3, and two drum piles of unknown origin near the fuel transfer station and three drum piles near the former

Tin City townsite. Unnamed Creek passes between the former Fuel Transfer Station and Dump No. 3.

1.2.2 Climate

Tin City LRRS is located on the Bering Sea near the Bering Strait. Breakup occurs around the end of May or the beginning of June (UAF 1978). The climate is maritime when the water is ice-free (from breakup to approximately October). Cloudy skies and fog are commonplace, daily temperatures are relatively uniform, and relative humidity is high. The freezing of Norton Sound to the southeast in November causes an abrupt change to a continental-type climate.

The mean monthly temperature in the Bering Straits region is 42 to 50°F in July and between -8 and 2°F in January (S&W 1993; UAF 1978). The area experiences a harsh, cold climate that results in the ground surface being frozen or snow covered for six to eight months of each year. The area is underlain by permafrost that is likely continuous in upland areas and absent or depressed near the beach. Winds can reach up to 90 miles per hour (mph) (UAF 1978). The mean annual precipitation is 19.4 inches, and the maximum 24-hour precipitation is 2.2 inches. The prevailing wind direction is from the north at an average speed of 15 knots and winds can reach up to 90 mph (ES 1985; UAF 1978).

1.2.3 Geology

Information on the geology of the site has been compiled from previous reports and from the September 1994 site visit. Subsurface information for the Tin City LRRS facility is limited to one log of a subsurface water supply well (Figure 1-3) at the Lower Camp; the well boring penetrated 9 ft (2.7 m) of unconsolidated colluvium before reaching granitic bedrock; the well log does not mention frozen ground.

The geologic features exposed at the installation are shallow bedrock consisting of granite and limestone, and unconsolidated surficial sediments. The unconsolidated surficial sediments include beach sands and gravels at the beach, alluvial deposits in the creek beds, and discontinuous, relatively thin colluvium and talus on the steep bedrock slopes. The harsh climatic conditions naturally limit soil development. Tundra vegetation is present intermittently at the Airstrip and Beach areas. The estimated distribution of the rock types is shown in cross-section representations for the Beach, Lower Camp, Tramway, Top Camp, and Substation Areas (Figure 1-4) and for the Airstrip (Figure 1-5). The geologic units are important in estimating the site-specific hydrogeologic conditions for developing the conceptual models.

The landform of Cape Mountain is composed of granite, and the Top Camp facilities are built on the granite. Because of the steep slopes, harsh climate, and hard rock surfaces, soil development is not extensive on the granite outcrops. Unsorted, unconsolidated colluvium and talus (broken rock transported downhill by mass wasting processes) is present as a discontinuous thin layer on the granite slopes (WCC 1988).

Limestone bedrock is present under the eastern portion of the camp, including approximately the eastern third of the Lower Camp and all of the Airstrip area. The contact between the granite and limestone units is the location of the lode (hard rock) tin deposits mined during the early 1900s.

The Airstrip area is underlain entirely by limestone and is generally of lower relief and has thicker colluvium than the areas underlain by granite. The surficial deposits are weathered, broken rock, unsorted and with a wide range of grain sizes. The surficial deposits are covered in places with tundra vegetation and contain surface water that is estimated to be a seasonal active layer above permafrost in the lower portion of the unconsolidated material. The thickness of the unconsolidated material in the Airstrip area is unknown.

Alluvial (stream transported) and beach sediments are present in the low-lying areas of the facility, in the creek drainages and at the Beach area. The beach sediments are mixed sand and gravel. The sediments of the lower Cape Creek drainage were formerly worked for placer tin. An organic rich peat layer or tundra mat is exposed in the beach profile close to the ocean at the Beach area. The peat layer is approximately one foot thick and is buried approximately one foot deep below beach sediments where it is exposed.

Permafrost occurs throughout the Seward Peninsula and is likely to be present in the Airstrip area and the Beach area. At some Lower Camp locations (e.g., SB E3, SB K2), frozen ground was encountered at a depth of about 4 to 10 feet bgs during the July investigation, indicating the presence of permafrost. At the Airstrip, frozen pore water was observed at a depth of about 4-6 feet in the gravel pad, which would be comparable to typical depths of thaw (about 5 feet) in gravel pads in northern Alaska. On the beach, the presence or absence of permafrost is unclear, since subsurface investigation close to the Bering Sea was terminated at 1 foot bgs when subsurface water was encountered at 0.6 foot (SB B6). Farther up the beach, subsurface investigation was terminated at 1 foot bgs due to auger refusal, which was likely due to bedrock or large cobbles (e.g., SB 3, SB 4, SB 5). By definition, permafrost areas are defined as any area where the temperature remains below 32°F for 2 consecutive years. Typically, it is difficult to characterize subsurface soils along the shoreline, since unfrozen saline surface water from the Bering Sea permafrost along the shore. Due to the lower freezing point of salt water, unfrozen pore water can be present in permafrost, especially in areas adjacent to the shore.

1.2.4 Subsurface Water

Little information is available on subsurface water at the installation. The base water supply is obtained from a subsurface water well located north and topographically uphill from the Lower Camp (Figure 1-6). The Beach, Lower Camp, and Airstrip are topographically downgradient of the drinking water wells. The Top Camp and White Alice sites are topographically upgradient, but as shown in Figures 1-2 and 1-6, are over a mile away from the drinking water wells and due to the topography in the area (Figure 1-2) are unlikely to drain toward the drinking water wells. This sentence is also added to the body of the report in Section 1.2.4 (Subsurface Water). The base supply well was drilled to a total depth of 69 feet (21.0 m) and is completed in fractured granitic bedrock. The well produces 32 gallons per minute (gpm) (0.1 cubic foot per second [cfs]) (USAF 1991). A water sample from the supply well was analyzed for TCL/TAL compounds during the SI. No contaminants were detected in the water sample (WCC 1993).

A well log for a subsurface water well at the site is shown in Figure 1-3. The well log is believed to be from a test well located downhill from the supply well (Figure 1-6). The base supply well and the other two wells near the supply well are the only wells known to exist on the facility or in the area of Tin City (USAF 1991).

An infiltration gallery was formerly used to obtain some of the water for the facility. The gallery was located near the supply wells and used a surface piping system to intercept a fault to produce water (ES 1985). Information obtained during the 1994 site visit indicates that the gallery is not currently in use.

Seeps were observed at the beach area coming to the surface from unconsolidated beach deposits that are estimated to be less than 10 feet (3.0 m) above sea level. The existence of permafrost at the beach is unknown, and the distribution of subsurface water and seawater in the unconsolidated beach deposits is unknown. The surface water in this area is estimated to be connected to seawater during the summer season as the surface water runs downhill to the ocean and as wave and tide action carries seawater over or through the natural berm to the pond and the area of the seeps.

Surface water seeps from within unconsolidated surficial deposits were observed at the Airstrip near ST 12, UST #16 and at the beach near AOC 1, Spill/Leak #5 at the fuel pump house at Bldg. 123, during the September 1994 site visit. It is not known whether these seeps are intermittent. The thickness of the surficial deposits above the limestone bedrock at the Airstrip is unknown. The seeps observed in this area are estimated to be from a seasonally active layer in the unconsolidated material above permafrost, or from water perched at the contact between unconsolidated deposits and bedrock. The depth to subsurface water at the Airstrip area is unknown but is estimated to be greater than 50 ft (15.2 m) in the limestone bedrock.

1.2.5 Surface Water

Surface water at Tin City LRRS occurs as creeks draining the relatively steep mountainsides, in a shallow pond near the beach, and as seeps from the ground surface. Because of the cold climate at the installation, all of the surface water features are expected to be frozen for approximately seven to eight months of the year. Based on the research conducted for previous work, and the information gained during the September 1994 site visit, it appears that no direct human use of surface water is occurring at the facility.

The surface of the facility is drained by four creeks, all of which discharge into the Bering Sea (Figure 1-2). The Top Camp area is drained to the southeast by Paulina Creek. The headwaters for Boulder Creek, the nearest creek north of the Top Camp, is approximately a mile from the installation. The Lower Camp is drained by an unnamed creek in sections 14 and 27, and by Cape Creek and its tributary, First Chance Creek. The area of the Airstrip is drained by Cape Creek to the west and by Lagoon Creek to the east.

Surface water ponds in a low-lying area located near the beach behind a low natural berm. The ponded water is unnamed and is approximately 500 x 200 feet (152.4 x 61.0 m), and less than 5 feet (1.5 m) deep. No major inlets or outlets to or from this water body have been mapped in

previous investigations; however, during the September 1994 site visit, the surface water was observed to drain to the west into the unnamed creek.

Surface water seeps were discussed in Section 1.2.4, Subsurface Water.

1.2.6 Biology and Sensitive Environments

The biology of the Tin City LRRS was researched during the TSD/ROD (WCC 1988) and is reported below.

Tin City is adjacent to the offshore Alaska Maritime National Wildlife Reserve (AMNWR), which was created in 1980. The boundary between the Chukchi Sea Unit and the Bering Sea Unit of AMNWR is located just northwest of Tin City at Wales. The Bering Sea Unit extends from Norton Sound to the Pribilof Islands. Nearly all of AMNWR is very rich in seabird life. Some common sightings in the area of Wales include horned puffins (*Fratercula corniculata*) which inhabit the steep rock headlands. Common and thick billed murres (*Uriaa spp.*), black-legged kittiwakes (*Rissa tridactyla*), gulls (*Larus spp.*) and cormorants (*Phalacrocax spp.*) are also commonly seen. Lopp Lagoon, a large, shallow, protected lagoon just north of Wales, is prime habitat for migrant water birds such as eiders (*Somateria spp.*), oldsquaws (*Clanqula hymalis*), scoters (*Melanitta*), emperor geese (*Philacte canagica*), loons (*Gavia spp.*), and others. No spectacled or Steller's Eider or Eider nests were noted during a survey conducted in 1994 (ABR 1995). Brood surveys were not conducted at Tin City during the 1994 Eider survey since no birds or nest were noted and due to a lack of suitable habitat. Common raptors include golden eagles (*Aguila chrysaetos*) and gyrfalcons (*Falco rusticolus*). The area supports a very large migrant bird population. Peregrine falcons (*Falco peregrinus*), have been known to occur in the Norton Sound area. The arctic Peregrine falcon, which was removed from the endangered species list in 1994, is the species of Peregrine falcon most likely to be present in the Tin City area.

Common mammals on the Seward Peninsula include brown bears (*Ursus arctos*), which are found from mid-April to early November in conjunction with Arctic ground squirrels (*Citellus parrvii*), a major food source for bears. Caribou and reindeer (*Rangifer spp.*), moose (*Alces alces*), red fox (*Vulpes fulva*), and two species of lemmings (*Synaptomys borealis*) and (*Lemmmus trimucronatus*) are also commonly found on the Seward Peninsula.

The vegetation of the area is differentiated by two different terrain types on each parcel of USAF land. At the Airstrip, the runway and weather station east of Cape Creek are located in a vegetation type classified as wet tundra. The Lower and Top Camps west of Cape Creek are in an area classified as sparse alpine tundra. Wet tundra vegetation with moderate to good drainage contains dwarf willows (*Salix spp.*), cottongrass (*Eriiophorum spp.*), narrow-leaf Labrador-tea (*Ledum decumbens*), mountain cranberry (*Vaccinium vius-idaea*) and other various herbs, mosses and lichens. All vegetation is less than 3.28 feet (1 m) high. Alpine tundra is much drier and typically characterized by low mat-type vegetation interspersed with barren rock. Dwarf willows (*Salix spp.*) may be present in low amounts. Mountain avens (*Dryas spp.*), crowberry (*Empetrum nigrum*), sedges (*Carex spp.*), and lichens are plants that can occur sparsely on Cape Mountain. The Upper Camp is mainly unvegetated. The Lower Camp is sparsely vegetated. This is due to the rocky soil and extremely high winds the area receives.

One plant species which might occur in the Tin City area is listed as a "species of concern" by the U.S. Department of Interior for endangered species eligibility (1996). The plant is a small arctic sorrel (*Rumex krausei*) which has been found only twice in Alaska, near Cape Thompson and on the tip of the Seward Peninsula near Lost River. It is not known if this plant occurs at Tin City or within the boundaries of the Tin City LRRS.

The Tin City LRRS is not located within any federal, state, or locally-protected sensitive environments. No wetlands have been formally identified within four miles of the Tin City LRRS, based on prior research with the Alaska Department of Fish & Game (ADF&G) and the COE (USAF 1991).

The creeks of the Tin City area have not been included in the ADF&G catalog of waters important for habitat of anadromous fishes.

1.2.7 Demographics

Tin City LRRS is an active installation and currently has a permanent, year round population of four resident civilian USAF contractor personnel (USAF 1994). The installation had higher staffing levels in the past, but staffing has decreased over time and was reported as 18 in 1985 and six in early 1992 (USAF 1991; USEPA 1992a). Estimated current year-round staffing is three to four persons on average at Tin City LRRS. No children are present on the site. The installation water supply consists of one supply well constructed in 1985 (USAF 1991). The water supply well location, is shown on Figure 1-6. Based on our current understanding, the water supply well is topographically above or removed from the IRP Sources and AOC slated for investigation in 1995. No TAL/TCL constituents were detected in samples collected from the water supply well (WCC 1993). Therefore, no exposure pathway is indicated.

In addition to the USAF staff, Richard Lee, the civilian trading post operator, resides in the abandoned community of Tin City during the summer. Historically, there was a community of Tin City located approximately 2,000 feet (609.6 m) southeast of the Tin City LRRS. ES (1985) identified wells that were used to supply water to residents and speculated that water supplies from wells may have potentially been impacted by the installation waste management activities. With the demise of mining at the Tin City Mine, the community was abandoned. The most recent documents report that the community of Tin City has no population during the winter months. During the summer, with the opening of the trading post, the population is one. The Trading Post operator uses the Tin City LRRS water supplies (USAF 1991). The status of any of the developed water sources, such as wells or standpipes, in the community of Tin City is unknown (USAF 1991). The USGS and Alaska Department of Natural Resources (ADNR) Water Resources Division were reported to have no additional water supply wells listed in their database for this area (USAF 1991).

Therefore, it appears that the total number of people in a 4-mile (7.4-kilometer) radius of the site is currently five adults (four USAF personnel and one trading post operator) and no children.

The area surrounding Tin City LRRS is very sparsely populated. As shown on Figure 1-1, the nearest population is the village of Wales. The Tin City LRRS is approximately 5-1/2 miles southeast of Wales, a Native Alaskan community, which has a permanent resident population of approximately 165 people (Wales Post Office 1995). The village is separated from the Tin City LRRS by Cape Mountain which rises from sea level to 2,289 feet (697.7 m). The mountains are reported to create a complete hydraulic separation between the watersheds, effectively isolating the Tin City site (TSD/ROD 1988; USAF 1991). Based on the USGS map updated in 1973, one additional cabin is located within a 4-mile (7.4-kilometer) radius of Tin City LRRS. Occupancy of the cabin was reported as unknown (USAF 1991).

1.2.8 Land Use

The Tin City LRRS is currently an active USAF Station. According to current USAF information, the long-term plan is for it to remain active indefinitely. The only road access to Tin City LRRS is a road leading from Wales to Tin City. Air traffic is prohibited, unless prior clearance is obtained from the site commander (USAF 1991).

The installation at Tin City became operational as a coastal surveillance site in 1953 and was maintained by a military staff of 95. In 1985, 618 ac (250 ha) were officially set aside for military use by Public Land Order (PLO) 5187. In 1959, the same PLO granted military use of an additional 6.2 ac (2.5 ha) to be used for the White Alice site. Rights-of-way exist for roads leading to the different sections of the installation. The WACS was built in 1958 replacing the high frequency radio system. The WACS was deactivated in 1975 and replaced with an Alascom-owned satellite earth terminal system. In 1977, Alaska Air Command (AAC) implemented a site support contact with RCA Services which eliminated 81 military positions at Tin City LRRS (ES 1985). A Joint Surveillance System (JSS) was installed in 1982.

Most of the land surrounding the installation was conveyed in March of 1982 to the Bering Straits Native Corporation in conjunction with the Wales Native Corporation. Several hundred hectares, located 1.9 miles (3 kilometers) northeast of the installation, are currently owned by the ADNR Division of Research and Development. The installation boundaries do not come into contact with ADNR land. The 6.2 ac (2.5 ha) at the White Alice site were turned over to the Navy Facility Engineering Command in 1985. There are several mining claims situated between the two individual installation boundaries along Cape Creek including two mining claims that are within or intersect the installation perimeter near the Lower Camp. Both of these parcels are small (4 ac [1.6 ha] each) and near the installation boundary. The title to this land was granted to the Bartels Tin Mining Company in 1911 (WCC 1988).

Many of the buildings located at the facility have been abandoned and/or slated for demolition.

The Tin City LRRS land is owned by the USAF, with the exception of land in the vicinity of the beach, which is owned by R. Kirk Dunbar, P.O. Box 1150, Phoenix, Arizona, 85001 (USAF 1994). Additionally, the site is adjacent to the Alaska Maritime National Wildlife Refuge (ES 1985).

Two communities are in the vicinity of the Tin City LRRS, as discussed in Section 2.2.7. The Tin City former townsite, located 1/2 mile (0.80 kilometer) east of the Lower Camp, was populated in the past, but is currently abandoned, except for summer use by the Trading Post operator (ES 1985).

The Tin City LRRS is not generally used by the inhabitants of Wales, except for periodic, brief visits to the Trading Post for supplies and the beach for fishing. According to local sources (PHS 1994), the population of Wales uses the following specific plants and animals in the vicinity of Wales for subsistence:

- Humpback whale and salmon around York, which is approximately 15 miles (24 kilometers) south of Tin City
- Blackberries on the cliffside between Tin City and Wales
- Salmon berries on the mountainside between Tin City and Wales
- Walrus, seal, bearded seal, and whales in the ocean between Wales and Tin City
- Moose (back in the mountains)
- Reindeer herd which migrates between Shishmaref and Brevig

1.2.9 Cultural and Archeological Resources

In remote Alaskan locations, cultural and archeological resources include Native American burial grounds, sacred areas, and other areas of cultural importance. There are no comprehensive listings of state-wide cultural and archeological resources. Generally, local Native American communities provide information on the location of the areas.

For preparation of this RI/FS Report, Wales Native Corporation was contacted and asked to identify all areas that are of cultural significance. In addition to the cultural and archeological resources, Wales Native Corporation also included other areas, such as private mining claims. The areas identified by the Wales Native Corporation are shown on Figure 1-7.

1.3 SITE INVENTORY

This section provides a description of the Tin City LRRS facility and a summary of previous IRP work conducted at the site. Communications with the United States Environmental Protection Agency (USEPA) and the ADEC regulatory agencies regarding the work are also summarized. Table 1-1 summarizes the previous IRP work.

1.3.1 Site Description

Tin City LRRS is located near the western tip of the Seward peninsula in northwestern Alaska (Figure 1-1). It was one of the ten original permanent aircraft control and warning sites constructed in Alaska in the early 1950s. The facility is actively used today, and the USAF intends to retain the facility as an active installation indefinitely. Tin City LRRS is a remote radar installation on a rocky, mountainous site, which fronts the Bering Sea near the Bering Straits. Elevations across the site range from sea level to 2,285 feet (ft) (696.5 meters [m]).

The site is remote, generally inaccessible, and has a cold and harsh climate. The harsh climate results in frozen ground and frozen surface water for most of the year. These conditions naturally limit the exposure of humans or animals to the contaminants at the source areas. The remoteness of the site and the harsh climate limit the implementability and escalate the cost of remedial alternatives. Preservation of fragile tundra and permafrost are important considerations in the design of investigation and remediation activities.

The LRRS facility is operated and maintained by civilian USAF contractor personnel who live at the site. The Native village of Wales is located approximately 5-1/2 miles northwest of Tin City LRRS and Wales residents can travel to Tin City by a road through the mountains (Figure 1-2). Otherwise, the installation is surrounded by uninhabited land (Figure 1-1) and is accessible only by airplane or boat. The plants and animals present are migratory or those that are adapted to withstand the cold. Tundra vegetation is present over some of the site. Permafrost likely underlies the site in upland areas and is absent or depressed near the beach.

1.3.2 Previous Investigative Activities And Documentation

Several Phases of IRP work have been completed at Tin City LRRS, beginning with a Phase I Records Search in 1985. The following is a brief summary of the work from each phase and the conclusions. Regulatory oversight has in the past been provided from USEPA and ADEC. After a PA/SI was completed in 1992, USEPA reviewed the SI and informed the USAF that the facility was not considered for inclusion on the NPL and that USEPA would no longer provide oversight. ADEC has provided oversight of IRP work since that time. A summary of the previous IRP work and closed source areas is presented in Table 1-1.

1.3.2.1 Phase I Records Search

In September 1985, ES (1985) conducted a Phase I Records Search for the AAC- Northern Region, including Tin City LRRS and seven other LRRS locations. The purpose of the Phase I records search was to identify and prioritize locations where releases of hazardous materials might have occurred in the past, resulting in a hazard to human health or the environment. Twelve AOC at Tin City LRRS were evaluated on the basis of field inspections, reviews of AAC and installation records and files, interviews with installation personnel, and the assessment of waste characteristics, pathways for migration, potential receptors, and specific characteristics of each site related to waste management practices. Of the twelve AOC, eight sites were found to have potential for contaminant migration and contamination (Table 1-1, Figure 1-6). The sites were: a dump at the Upper Camp (DP 08); a landfill near the runway (LF 02), a dump below the Lower Camp (LF 09), a waste accumulation area at the Lower Camp (between buildings 110 and 119) (SS 01); spill/leak areas at a pipeline near the incinerator (Bldg. 150) at the Lower Camp (SS 07); spill/leak at the White Alice site (SS 06); White Alice site PCB/oil disposal (DT 05); and past runway oiling (SD 04).

These sites were scored and ranked using the Hazard Assessment Rating Methodology (HARM) scoring system. Recommendations were made for additional investigation and monitoring work at the eight sites.

1.3.2.2 Technical Support Document for Record of Decision

In February 1988, Woodward-Clyde Consultants (WCC) prepared a Record of Decision (ROD) for six sites at Tin City LRRS, accompanied by a Technical Support Document (TSD) for ROD (WCC 1988). The six sites included five of the eight sites identified in the 1985 Phase I and one additional site, called the "mid-mountain dump" (Figure 1-6). The remedy selected for all six sites was "no further action." The ROD was signed by representatives of the USAF, the USEPA Region 10, and ADEC between February 1988 and September 1988.

Two sites identified in the Phase I study were not addressed in the ROD or the TSD. The landfill near the runway (LF 02) was not addressed because it was "currently permitted by ADEC." The White Alice facility (including SS 06 and DT 05) was not addressed because it had been transferred to the Department of the Navy prior to February 1988 and has since been outside the scope of USAF IRP work.

The TSD was prepared following a 1987 field visit which verified that cleanup activities had occurred at several of the Phase I sites and that no evidence of contamination was observed at the sites where cleanup had not occurred. The findings presented in the TSD were based on the Phase I report prepared by ES in 1985, a 1987 site visit conducted by WCC and USAF personnel, a comprehensive literature search and review, an inventory of the known chemicals and hazardous materials at the facility, and a Priority Assessment Form submitted by the USEPA. The analysis included a qualitative RA and an analysis of alternatives.

The "no action" alternative was selected as the preferred alternative for all sites because it presented the lowest or same risk to human health as other alternatives and also had a lower environmental and economic cost than any other alternatives at each of the sites.

1.3.2.3 Preliminary Assessment/Site Investigation

Preliminary Assessment

In December 1991, USAF personnel prepared a Preliminary Assessment (PA) for Tin City LRRS (USAF 1991) using the list of questions in the USEPA "Preliminary Assessment Data Requirements for Federal Facility Docket Sites." The PA contains information on sampling and analysis data, suspected sources of contamination, surface water and subsurface water, drinking water wells, site setting, land use, and population for the area surrounding Tin City LRRS.

The information presented included a summary of the Phase I report (ES 1985) and the TSD (WCC 1991). Information related to the site setting and land use, local receptors, surface water, physiography, and sensitive environments was provided by the USAF.

USEPA reviewed the PA and responded with a letter of comments (USEPA 1992a) Additional detail was requested for specific sections.

Site Investigation

WCC conducted a site investigation during August - September 1992 (WCC 1993). The SI was conducted to collect information to complete a Hazard Ranking System (HRS) score for Tin City LRRS to evaluate the site for possible inclusion on the NPL. Sites were selected for sampling and analysis based on the information in the PA (USAF 1991). Some of the sources were subsequently eliminated from consideration based on historical information that the source consisted of fuel spills or that the source was not a threat to potential target populations.

Soil samples were collected from the Landfill (LF O2), Dump No. 2 (LF 09), Waste Accumulation Area (SS 01), the White Alice Site (DT 05), and the Runway Oiling area (SD 04). Soils were analyzed for Target Compound List (TCL) volatile organics, semi-volatile organics, pesticides and PCBs, and Target Analyte List (TAL) metals. Background soil samples were analyzed for pesticides and PCBs and metals. One subsurface water sample was collected from the potable water well and analyzed for TCL/TAL compounds. A sediment sample was collected from a creek on the facility and from the ocean near the outfall of the creek. Sediment samples were analyzed for TCL/TAL compounds.

USEPA reviewed and evaluated the Site Investigation Report in accordance with the HRS. USEPA indicated that Tin City LRRS was not proposed for inclusion on the NPL and a recommendation of no further remedial action planned (NFRAP) was included in the USEPA's Federal Agency Hazardous Waste Compliance Docking tracking system (USEPA 1993).

1.3.2.4 SS 14a: Three USTs (Removed) at SP 4 Near Bldg. 76-200 and SS 14b: AST #10 (Removed) at SP 4 Near Bldg. 76-200

In August 1991, a USAF contractor reported a release from a 1,000-gallon (3.8-m^3) UST near Bldg. 76-200 at the Lower Camp. The release was discovered when three inactive USTs at this location were removed; the release was thought to have resulted from overfilling of the UST that had been used to store diesel fuel. A report was filed with ADEC on 27 August 1991 (GE 1991a). The release from the tank has been designated source area SS 14, Spill/Leak #4 near Bldg. 76-200 (Figure 1-8).

In September 1991, the contractor removed the three USTs near Bldg. 76-200 and collected soil samples from the tank excavation (GE 1991b). The tanks removed were two 6,000-gallon (22.7-m^3) diesel tanks and one 1,000-gallon (3.8 m^3) diesel tank; all three tanks were in a common tank pit, 25 ft (7.6 m) from the building. The tank excavation measured 50 x 100 x 15 feet deep (15.2 x 30.5 x 4.6 m). Eleven soil samples were taken from the tank excavation pit and sent to a laboratory for analysis of TPH-diesel range by USEPA method 8100 modified. Sample locations were documented in photographs in the original report. A summary of the analytical results is shown in Table 1-2.

The tank excavation was lined with a plastic liner and then backfilled with the material that was removed from the pit (GE 1991b). The excavated material was coarse to fine unsorted fill typical of the Lower Camp area.

1.3.2.5 SS 13a: Stained Soils from Spill/Leak #3 at Lower Tram (Not Including AST); and SS 13b: Transformers Formerly Sited on Stained Concrete Pad and Soils at Lower Tram

In July 1993, a USAF contractor unexpectedly encountered a buried 55-gallon (0.2-m^3) drum during construction work in the fill adjacent to the Lower Tramway Terminal (LTT). The drum had been punctured and contained diesel fuel. The drum was removed, and samples were collected from the rocky, unconsolidated fill in the vicinity of the drum and were sent to a laboratory for analysis for TPH-diesel range. A report summarizing the results was prepared (Martin Marietta 1993). The analytical results are summarized in Table 1-2.

The release from the buried drum has been designated source area SS 13a.

1.3.2.6 ST 12a: UST #3 (Removed) at Power Plant (Bldg. 110); ST 12b: UST #20 (Removed) at Composite Building (Bldg. 150); and ST 12c: 4,000-Gallon Diesel Fuel Tank UST #16 (removed) at Weather Station, Bldg. 132

The USAF closed and removed four USTs at Tin City LRRS between August and September of 1993. The tanks were UST #3, a 10,000-gallon (37.9-m^3) diesel tank located south of the power plant (Bldg. 110); UST #9, a 300-gallon (1.1-m^3) gasoline tank located east of Bldg. 110; UST #16, a 4,000-gallon (15.1-m^3) diesel tank located west of Bldg. 132 at the Airstrip, and UST #20, a 300-gallon (1.1-m^3) waste oil tank located east of Bldg. 150. The locations of the excavated tanks are shown on Figure 1-6 (UST #9) and Figure 1-8 (USTs #3, #16, and #20).

Soil samples were collected from each tank location and were sent to a laboratory for analysis of TPH-diesel range, TPH-gasoline range, BTEX, and TCLP Metals (silver, arsenic, barium, cadmium, chromium, mercury, lead, and selenium). Results of the laboratory analyses are summarized in Table 1-2. Each UST pit was backfilled with the material that was removed from the excavation.

A tank closure report was prepared by the USAF for review by ADEC. The report indicated that UST #9 qualified for clean closure based on the analytical results of the closure samples and the application of the ADEC soil cleanup matrix. The sites of UST #3, UST #16, and UST #20 did not qualify for clean closure using the ADEC soil cleanup matrix, and are considered to be active IRP sources. The group of tank locations was collectively designated ST 12 (USAF 1993a; and USAF 1993b).

For clarity, the three former UST sites that are considered to be active IRP sources will be referred to as ST 12a, UST #3; ST 12b, UST #16; and ST 12c, UST #20.

1.3.2.7 Regulatory Correspondence Concerning IRP Activities

In a November 1993 letter from ADEC to the 11th Air Control Wing, ADEC reaffirmed its concurrence with the no further action recommendation for six sites at Tin City LRRS included in

the 1988 ROD. ADEC indicated that it considers four sites at Tin City LRRS to be active IRP sites: DP 011, Dump #3 at Beach; ST 12, Former USTs; SS 13, Spill/Leak #3 at LTT; and SS 14, Spill/Leak #4 near Bldg. 110 (ADEC 1993b).

ADEC reviewed the Site Assessment report for USTs #3, #9, #16 and #20 and responded with a January 1994 letter to the 11th Air Control Wing (ADEC 1994). ADEC indicated that the UST #9 site is a clean closure and that no further action is required. The sites of former UST #3, UST #16, and UST #20 are considered active IRP sites. ADEC indicated that the soil cleanup matrix level for UST #16 should be Matrix Level B because of the presence of water in the tank excavation. ADEC requested additional information concerning the extent of surface water contamination at UST #16.

1.3.2.8 Field Inspection and Site Scoping

On September 1, 1994, representatives from the USAF, EA, and Montgomery Watson visited Tin City LRRS to observe the field conditions and tour the IRP Source Areas and AOC identified for investigation during the 1995 field season. Site conditions were documented with still photography and videotape. Observations of the site setting and field conditions were used along with the previous IRP information to develop the RI/FS strategy.

The group was on-site for approximately six hours, and toured the areas of the Lower Camp, the Airstrip, and the Beach. The Upper Camp was not toured due to time constraints. During the visit USAF personnel identified the IRP sources for investigation during the 1995 field season. The 1995 investigation was planned to include three active IRP sources where field investigation had been previously performed (ST 12, SS 13, and SS 14), one active IRP source area (DP 011) and two AOC (AOC 1, 2) each of which was not previously investigated.

Locations of the active IRP sources and AOC included in this investigation are shown in Figure 1-8. A limited amount of existing information is available from previous investigations of ST 12, SS 13, and SS 14. The existing information from previous investigations is summarized in tables in Appendix I. During the September 1, site visit, additional information was relayed by USAF personnel concerning SS 13: the transformer pad adjacent to the LTT should be included in the investigation. The transformer pad is a concrete pad approximately 6 x 4 feet (1.8 x 1.2 m) located south of the LTT (Figure 1-8). A transformer was formerly located on this pad. Field observations of the area around the pad indicate staining of the corner of the pad.

Existing information on the areas not previously investigated under the IRP program is documented in the following paragraphs.

<u>DP 011, Dump #3 at Beach</u>

DP 011 consists of Dump #3, which is documented to be an informal dump area adjacent to the beach (Figure 1-8). The dump area is in a shallow depression approximately 500 x 200 feet (152.4 x 61.0 m). The center of the depression retains surface water, which is estimated to be less than 5 feet (1.5 m) deep. The surface water drains westward into Unnamed Creek. Rusted metal

debris of unknown origin including abandoned equipment, scrap, and drums is scattered across the area; some of the debris rests in the surface water.

Location of the potential source is shown in Figure 1-8.

AOC 1, Spill/Leak #5 at Bldg. 123, POL Pump House

AOC 1 consists of Spill/Leak #5 at Bldg. 123, POL Pump House. The concrete foundation to the former POL Pump House (Bldg. 123) is located at the west end of the beach near the high water mark. The POL Pump House conveyed fuel off loaded from barges through a pipeline which leads to the Lower Camp fuel storage system. Field observations of the area around the POL Pump House indicate discoloration of the beach sediments.

Location of the potential source is shown in Figure 1-8.

AOC 2, All Top Camp Fuel Tanks

Top Camp was not toured during the site visit due to time constraints. USAF personnel indicated that several fuel tanks are located at Top Camp. The condition of the tanks and underlying soils is unknown.

1.3.3 Current Site Status

Previous IRP work has led to closure of the following nine IRP sources:

- DP 08, Dump No. 1
- DT 05, White Alice PCB/POL
- LF 02, Landfill (to be addressed as a third party site)
- LF 09, Dump No. 2
- LF 10, Mid-Mountain Dump
- SD 04, Runway Oiling
- SS 01, Waste Accumulation Area
- SS 06, Spill/Leak No. 1
- SS 07, Spill/Leak No. 2

The location of the closed IRP sources is shown on Figure 1-6.

The 1995 field investigation was planned and executed to address the following six additional IRP Sources and AOC:

- DP 011, Dump #3 at Beach
- ST 12, Four USTs (one previously closed)
- SS 13, Spill/Leak #3 at Lower Tramway Terminal (LTT)
- SS 14, Spill/Leak #4 near Bldg. 76-200
- AOC 1, Spill/Leak #5 at the Fuel Pump House at Bldg. 123
- AOC 2, All Top Camp Fuel Tanks

One additional site, AOC 3, the substation, was identified during the field investigation and investigated.

Many of the IRP Source Areas and AOC are large geographic areas and consist of several sources that may have released contaminants to the environment. For example, ST 12 includes distinct working subsets for investigation: each of four tanks located in different locations across Tin City LRRS (one UST is closed, three will be investigated). In order to clearly identify all situations within an IRP Source Area for investigation and depict them on figures, the individual situations for investigation within the IRP Source Areas are identified separately in the rest of this document and denoted with an alphabetic designator. The subsets for the IRP Source Areas and AOC are shown in Table 1-1. The locations of the IRP Source Areas and AOC identified for inclusion in the 1995 investigation are shown in Figure 1-8.

1.4 REMEDIAL ACTIONS

An Air Force contractor, ACCI, Inc., conducted an Interim Remedial Action (drum removal) at Tin City LRRS between August 1, 1995 and August 23, 1995.

The intent of the removal action was to eliminate the potential for release of any remaining drum contents to the environment and removal of unsightly empty drums. According to the draft report on the ACCI, Inc., activities (WCC 1995a) and draft tables and figures (WCC 1995b), the work was concentrated in nine areas:

- Crushed Drum Area A
- Crushed Drum Area B
- Crushed Drum Area C
- Drum Crushing Pad (soil sampling)
- Eastern Drum Area
- Central Drum Area
- Western Drum Area
- Sub B Drum Area
- Sub D Drum Area (drum sampling only)

The nine areas were designated by the Air Force as part of DP 011 and are referred to as DP 011b in this report. The Drum Area locations are shown on Figures 1-9 through 1-19.

The Interim Remedial Action consisted of:

- removing any drum contents from the abandoned drums

- consolidation of drum contents for off-site testing and disposal

- removal of the abandoned drums and metal debris

- collection and laboratory analysis of representative soil samples from each of the eight drum areas

A complete description of the IRA and results is contained in the final report prepared by ACCI, Inc.

Laboratory results from the soil sampling are presented in Tables 1-2 through 1-9. The results show some areas with elevated levels of petroleum hydrocarbons.

2.0 PROJECT ACTIVITIES

2.1 PROJECT OBJECTIVES

The project scope was to conduct an RI/FS for the eleven areas identified by the USAF for investigation during the 1995 field season. One additional AOC was added during the field investigation for a total of twelve areas. The twelve IRP source areas investigated during the 1995 field season were:

IRP Number	Description
DP 011	Dump #3 at beach with abandoned drums and machinery
ST 12a	UST #3 (removed) at Power Plant (Bldg. 110)
ST 12b	UST #20 (removed) at Composite Building (Bldg. 150)
ST 12c	4,000-gallon diesel fuel tank UST #16 (removed) at Weather Station (Bldg. 132)
SS 13a	Stained soils from spill/leak #3 at lower tram (not including AST)
SS 13b	Transformers formerly sited on stained concrete pad and soils at lower tram
SS 14a	Three USTs (removed) at SP 4 near Bldg. 76-200
SS 14b	AST #10 (removed) SP 4 near Bldg. 76-200
AOC 1	Spill/Leak #5 at the Fuel Pump House at Bldg. 123
AOC 2	Fuel Tanks
AOC 3	Substation
BKG	Background

Table 2-1 shows the IRP sources and AOC, figure number of the map for each area; suspected source description and suspected contamination. Figure 2-1 shows the key to the maps. The RI/FS was consistent with the overall goals of the USAF IRP and focused on streamlining the RI/FS process to use existing information where possible and anticipate logical outcomes.

The project objectives were to:

- collect data of sufficient quantity and quality to adequately characterize the nature and extent of contamination in order to support development of a baseline RA, identify ARARs, and identify preliminary appropriate remedial alternatives, including natural attenuation;

- identify risks to human health and the environment posed by contaminants from the USAF activities by preparing a baseline RA.

The RI/FS process described in the following text was developed to procedurally investigate the five components of a typical RA: sources (including concentrations of contaminants of concern); release mechanisms (including contaminated media); transport mechanisms; points of exposure; and potential receptors. The identification of all five components provided a complete pathway to define the need for remediation. Incomplete pathways at any site or AOC preclude the necessity for remediation. The results of the investigation have been reported in this document, and recommendations for each site will be incorporated into the RI. Recommended actions have been

divided into three categories: (1) no further response action planned, (2) further study, and (3) remedial action.

These recommendations have been incorporated into this RI/FS. The data may be used to conduct a detailed feasibility study or remedial design at a later date, if needed. A summary of the field investigation strategy and objectives developed during the planning phase of the investigation for each IRP Source Area and AOC is presented in Table 3-1 of the Work Plan. The baseline RA provides the information to either support no further action at the site or define remedial action goals. A strategy and objective was developed specifically for each individual IRP Source Area and AOC in order to meet the specific data needs of that area.

2.2 FIELD ACTIVITIES

2.2.1 Field Program

This section details procedures used during the field investigative activities at Tin City LRRS. Field work included drilling and hand-digging boreholes, collecting samples from unconsolidated materials at the surface and from beneath ground surface, environmental sampling including sediment, surface water, wipe sampling, and background sampling.

Eleven areas were identified for investigation, and the general location of each area is shown on Figure 1-8. The sites were selected based on a review of historical site information, previous analytical results, and site survey information. Table 2-2 (Field Strategy and Objectives) of the Work Plan summarizes the strategy and tactics behind the information collected during this investigation.

2.2.1.1 Site Reconnaissance

Site reconnaissance was conducted with AFCEE personnel to confirm the current use and condition of surface structures and site setting conditions at all field locations. Site reconnaissance was an important means of identifying areas of possible contaminant releases and make possible the mapping of small but significant features that may not have been visible on existing maps or photographs.

Site reconnaissance included walking the site, making observations and taking notes as required. Field screening was conducted as necessary, with results recorded in the field logbook. Uses of buildings and structures that may be associated with contaminant sources are described in the field logbook and identified on the base map. Areas of stained soil and/or distressed vegetation are identified and described. Measurements from prominent structures (buildings, fences, etc.) were used to locate noted features to plot them accurately.

2.2.1.2 Work Area Maintenance

All work areas were maintained to: (1) prevent the spread of contamination as a result of investigation procedures, (2) provide for the integrity of the samples obtained, and (3) provide for

the safety of federal workers, contracted personnel, and/or other individuals in the vicinity of the project areas.

Access to work areas was monitored and thoroughly controlled. Standard work zones and access points for hazardous waste operations were established and maintained as site conditions warrant.

2.2.1.3 Borehole Drilling/Digging

Test borings were drilled with an AFCEE 611th drill rig or dug manually at some of the areas. All necessary permits and underground clearance for boreholes were procured prior to the commencement of drilling.

A metal detector was used to sweep the areas before drilling. Drilling was conducted at least 20 feet from overhead electrical lines. Soil borings were not advanced into permafrost.

Site safety monitoring was monitored continuously throughout the drilling operation in accordance with the Health and Safety Plan. A daily tailgate meeting was conducted by the On-Site Safety Officer prior to starting work.

The rig-dug boreholes were drilled using a hollow-stem auger system. Borehole depths were shallower as maximum depth was limited by encountering bedrock, permafrost or subsurface water (see Boring Logs, Appendix C). A hot water pressure cleaner was used to decontaminate the drilling equipment between borehole locations. Down-hole sampling equipment was decontaminated between sampling events. A description of the decontamination process is presented in Section 2.2.1.5.

Boring logs were continuously maintained throughout the drilling operation and include the name of the personnel involved, project name and number, name of the drilling contractor, the drilling method employed, the location of the boring measured relative to site structures and noted on a site base map, the boring or well identification number, the sample standard penetration blow counts, sample intervals and depths, any evidence of contamination, the sample recovery (inches recovered/inches driven), lithologic description, and total depth of the borehole. Each boring log was signed at the bottom by the field person logging the boring.

Lithologic descriptions of unconsolidated soils include grain size, color, texture, moisture content, stiffness or density, and descriptive comments (e.g., noting evidence of odor or staining). Unconsolidated soils were classified according to the Uniform Soil Classification System (USCS) and ASTM D-2487-85 using the Visual-Manual Procedure detailed in ASTM D-2488-84.

2.2.1.4 Surveying

The locations of all boreholes, wells, and sampling locations were marked with a 3-foot red top lath and had the sample identification number clearly marked. Wipe sample locations where there was suspected PCB contamination were outlined and numbered with a paint marker after completion of the wipe sample. Surveying was conducted by Air Force personnel following the field investigation. Survey data are presented in Appendix E.

2.2.1.5 Decontamination Procedures

Where possible, decontamination was carried out at the sampling site. A centralized decontamination station was established at the Tin City site near the Composite Building (#150). Emergency equipment (such as air horns, eye wash, and fire extinguishers) was located at the decontamination station at the sampling site.

1. Sampling Equipment: The following sequence of wash and rinses was used to decontaminate non-disposable sampling equipment prior to use and between samples:

   - washed and brushed with clean tap water
   - washed and brushed with laboratory grade detergent
   - rinsed with ASTM Type II water
   - rinsed with pesticide-grade methanol
   - rinsed with hexane
   - air dried
   - wrapped in aluminum foil or a new, clean, sealable plastic bag

   Non-disposable sampling equipment used in this investigation includes:

   - hand drilling augers
   - split-spoon samplers
   - sampling scoops

2. Drilling Equipment: Drilling equipment was decontaminated as follows:

   - All drilling equipment and materials were decontaminated at a designated on-site or off-site location prior to drilling operations, between borings, and when the project was completed. The drilling subcontractor furnished a pressure-washer and water tank with potable water.

   - The drilling auger, bits, drill pipe, and other equipment that went into the borehole were decontaminated by the drilling subcontractor by pressure washing until thoroughly clean.

3. Personnel

The following personnel decontamination procedures were used:

- Washed Neoprene boots (or disposable booties) with soap wash solution followed by clean water rinse. Removed booties and retained boots for subsequent reuse.

- Washed outer gloves in soap wash solution and rinsed in clean water. Removed outer gloves and placed into plastic bag for disposal or retained for subsequent reuse.

- Removed Tyvek® coveralls. Disposed of Tyvek® coveralls in plastic bag for disposal according to the waste handling plan in Section 2.1.10. Did not reuse.

- Removed surgeon's gloves and placed in plastic bag for disposal according to the waste handling plan in Section 2.1.10. Did not reuse.

- Thoroughly washed hands and face with clean water and soap.

2.2.1.6 Waste Handling

Existing information from previous investigations regarding the identity and extent of known or expected contamination was used to develop a waste handling plan. Investigative-derived wastes (IDW) resulting from the 1995 investigation consisted of the following waste materials:

- cuttings from boreholes
- soil samples not submitted for laboratory analysis
- decontamination fluids
- disposable protective clothing and supplies

Cuttings and unused soil samples: Cuttings from boreholes were segregated based on depth, when removed from the ground. The cuttings were placed back in the boring upon completion of the investigation at that location. All soil cuttings remained at the potential AOC.

Decontamination fluids: Decontamination water was evaluated in the field to determine the appropriate disposal method. The water was visually observed for the presence of free product or petroleum sheen. All decontamination water, since it had with no observable sheen or free product, was discharged to the ground surface.

Used methanol and hexane were containerized but evaporated due to the high winds. No disposal was necessary.

Disposable protective clothing and supplies: Used protective clothing was rendered unusable by cutting the garments into pieces, then the garment pieces and used supplies were bagged in sturdy plastic garbage bags. The bagged materials were transported and disposed as non-hazardous waste according to the standard procedures at Tin City LRRS or transported to Anchorage for disposal.

2.2.1.7 Sampling Procedures

This section describes the procedures used during sampling activities at the Tin City LRRS site. Sample collection procedures, sample custody protocols, the field QA/QC program, a summary of sample analyses, instrument calibration procedures, and record keeping procedures are detailed here. Table 2-3 summarizes by site the field activities conducted.

Field Screening: Field screening was conducted during site reconnaissance and during sample collection to identify contaminant sources in soils, and to verify the presence of contamination at a location without submitting samples to an analytical laboratory. The concentrations of airborne volatile organic compounds were monitored to establish appropriate worker safety procedures and to support subsequent sampling. Field screening was performed during site reconnaissance and sampling activities by visual inspections and conducting air monitoring using a PID. Field screening was performed according to the guidelines described below.

Screening Using a PID: During the field investigation, a Photovac Microtip 3000 IS with a 10.6 electron-volt (eV) probe was used for field screening of volatile vapors. During sampling activities, the PID was also used to select samples selected for laboratory analysis.

Surface soil samples were placed in a 40-ml vial. The vial was filled approximately half full of soil, the mouth covered with aluminum foil and capped. The covered vial was placed in a crock pot until the sample temperature was approximately 85°F. The tip of the PID was then pushed through the aluminum foil and the level of total ionizable compounds in the head space of the vial was recorded in the daily field logbook.

During drilling, subsurface soil samples were screened by inserting the tip of the PID into a space made in the soil in the split spoon sampler as soon as the sampler was opened. The PID reading was recorded on the boring log. When weather conditions (wind, rain) prevented direct readings, a half-full 40-ml vial was collected and a headspace reading was completed at a later time.

Surface and Near-Surface Soil Sampling: The following standard methods were employed during the Tin City RI/FS when surface and near-surface samples were specified for the tundra, soil or unconsolidated sediment or colluvium present at the installation.

Sample locations were determined in the work by reviewing historical information on site facilities and the location of existing structures. Surface samples were collected from specific stained areas to investigate the identity and concentration of any contaminants.

Surface soil samples were collected at depths from the surface to 6 inches below ground surface. The selection of the optimum sampling technique depended upon the depth, texture, structure, and moisture content of the targeted surface soils. The primary tools for collecting surface soil samples were shovels and hand augers.

Hand Auger: Hand augers were used to obtain samples at depths of up to 5 feet.

Samples to be submitted for analysis were collected first using the following procedures designed to minimize potential volatilization.

- Removed the hand auger from the ground and carefully removed an inch from the auger blades.
- Immediately filled the VOC sampling containers from the remaining soils in the auger head, fully packing the soil in the container and leaving no headspace.
- Immediately capped the container and secured the lid tightly.
- Placed the sample liner into a clean plastic bag and seal. Immediately placed the properly labeled and sealed sample liners in a cooler with gel ice and maintained at 4°C for the duration of the sampling and transportation period.

Sample material obtained for analytes other than VOCs were collected using the following procedure:

- Removed soil from the sample horizon with a hand auger or other device and placed it directly into a disposable pie tin or a clean stainless steel mixing bowl until sufficient material was present for the proposed analyses.
- Mixed the soil in the bowl thoroughly with a stainless steel spoon. All organic material, rocks, and pebbles greater than 0.5 inch (maximum dimension) were excluded during mixing.
- Filled prelabeled sample jars with equal portions of soil from each quadrant of the mixing bowl. Replicate samples were collected concurrently. Sealed each sample jar with the appropriate lid.
- Placed the properly labeled and sealed sample containers in a cooler with ice and maintained at 4°C for the duration of the sampling and transportation period.

Recorded soil sample characteristics in the field logbook or field boring log. Recorded all sample collection information (e.g., location, sample identification, sample type and depth collected, etc.) as described in Section 2.2.3.1, Sample Labeling and Section 2.5, Record Keeping. Followed sample custody and handling procedures as described in Section 2.2.3, Sample Custody.

Decontaminated all soil sampling equipment between sample locations according to decontamination procedures described in Section 2.2.1.5.

Replaced residual soil cuttings into the hand auger boring and replaced the sod layer. Placed a labeled survey marker identifying the sample location prior to leaving.

Subsurface Soil Sampling: Sampling of tundra, soil, or unconsolidated colluvium were collected from borings using a split-spoon driven by a drill rig. Standard penetration test data were recorded for each sample drive in blows per 6-inch interval.

Undisturbed subsurface soil samples were collected at 5-foot sample intervals using the Standard Penetration Test procedure split-spoon method. Sample material was selected for laboratory analysis based on field screening information. The rationale used for sample selection was recorded in the field logbook and/or on the field boring log, including field screening results. Undisturbed subsurface soil samples were collected using the following procedures.

- Labeled the appropriate sample containers with all necessary information. Drove a clean, standard, 18-inch long, split-spoon sampler into the soil a distance of 18 inches at the chosen depth interval, using a 140-pound hammer, free falling 30 inches. The blow counts were recorded on the soil boring log.

- The drillers relinquished the unopened sampler to the sampling crew when a split-spoon sample was collected. The sampler was placed on a clean surface, and the two halves of the split-spoon were separated.

- Neatly cleaved the soil with a clean stainless steel trowel or knife and inserted the tip of the PID between adjacent sections in the split-spoon sampler immediately upon retrieval and separation of the sampler. Recorded the PID response on the soil boring log.

- Immediately removed about 1/2-inch soil horizontally on soil core and filled the VOC container from soils remaining on the core, packing soils firmly, and leaving no headspace in the container.

- Placed sample container into a clean plastic bag and sealed. Immediately placed the properly labeled and sealed sample containers in a cooler with gel ice and maintained at 4°C for the duration of sampling and transportation to the laboratory, replenishing the gel ice as necessary.

- Placed the remaining sample material for analyses other than VOCs directly into a disposable pie tin or clean stainless steel mixing bowl until sufficient material was present for the proposed analyses. Mixed the soil in the bowl thoroughly with a stainless steel spoon. All organic material, rocks, and pebbles greater than 0.5-inch (maximum dimension) were excluded during mixing. Filled prelabeled sample jars with equal portions of soil from each quadrant of the mixing bowl. Replicate samples were collected concurrently. Sealed each sample jar with the appropriate lid.

- Placed the properly labeled and sealed sample containers in a cooler with gel ice and maintained at 4°C for the duration of the sampling and transportation period.

- Recorded soil sample characteristics in the field logbook or field boring log. Recorded all sample collection information (e.g., location, sample identification, sample type and depth collected).

- Followed sample custody and handling procedures as described in Section 2.2.3, Sample Custody.

- Decontaminated all soil sampling equipment between sample locations according to procedures described in the Sampling and Analysis Plan (EA 1995).

- The borehole was backfilled using bentonite chips, hydrated to form a surface seal.

- Placed a labeled survey marker identifying the boring location prior to leaving.

- Placed all soil cuttings, used protective clothing, and decontamination fluids in separate, properly labeled, sealed drums. Waste drums were stored in a predetermined containment area on-site following the completion of the field work.

Sediment Sampling: All sediment samples from surface water bodies were grab samples. Sediment sampling was conducted only after all surface water samples were collected at that location in order to avoid unnecessary turbidity. Samples were collected using the following procedure:

- Labeled the sample containers with all necessary information. Recorded water characteristics and surface conditions in the field logbook. Also recorded physical characteristics of the sediment (e.g., color, sheen, odor, turbidity).

- Collected an undisturbed sediment sample using a stainless-steel sediment dredge. Placed the sampler on a clean, flat surface. Immediately screened the sample for organic vapors using a PID and recorded the response in the field logbook. Observed the water surface for evidence of sheen created during sampling.

- Transferred sediment samples that were required for VOC analysis directly from the sampler to the appropriate prelabeled sample container as soon as possible, to reduce sample volatilization. Carefully filled the VOC sample container leaving no headspace. Immediately placed the properly labeled and sealed sample container in a cooler with Blue Ice and maintained at 4°C for the duration of sampling and transportation to the laboratory.

- Placed the remaining sample material for analyses other than VOCs directly into a disposable pie tin or clean stainless steel mixing bowl until sufficient material was present for the proposed analyses. Mixed the sediment in the bowl thoroughly with a stainless steel spoon. All organic material, rocks, and pebbles greater than 0.5-inch (maximum dimension) were excluded during mixing. Filled prelabeled sample jars with equal portions of sediment from each quadrant of the mixing bowl. Replicate samples were collected concurrently. Sealed each sample jar with the appropriate lid.

- Placed the properly labeled and sealed sample containers in a cooler with gel ice and maintained at 4°C for the duration of the sampling and transportation period.

- Recorded sediment sample characteristics in the field logbook or field boring log. Recorded all sample collection information (e.g., location, sample identification, sample type and depth collected, etc.) as described in the Sampling and Analysis Plan (EA 1995).

- Followed sample custody and handling procedures as described in the Sampling and Analysis Plan (EA 1995).

- Decontaminated all sediment sampling equipment between sample locations.

- Placed a labeled survey marker identifying the sediment sampling location prior to leaving.

Surface Water Sampling: Surface water samples were collected at the beach and as background samples. All surface water samples were grab samples.

Surface water samples were collected with minimal disturbance to the underlying sediments. Surface water samples were collected directly into preserved sample containers carefully ensuring that the samples were not contaminated or the preservatives over-diluted during the collection process. Water depth and sample depth were recorded for each location. The sample collection procedure was as follows:

- Labeled the sample containers with all necessary information. Recorded water characteristics and surface conditions in the field logbook. Also recorded physical characteristics of the sediment (e.g., color, sheen, odor, turbidity).

- Collected a water sample for field water quality measurements. Surface water pH, specific conductance, and temperature were measured using calibrated instruments and recorded in the field notebook prior to sample collection. Physical characteristics of the surface water (e.g., color, sheen, odor, turbidity) were recorded at the time of sampling.

- Collected surface water samples by slowly lowering the sampler into the water, taking care not to disturb the sediment.

- Filled surface water sample containers in the order of volatilization sensitivity (i.e., VOCs first, then other organic compound samples, and inorganic samples last). In particular, VOC sample containers were carefully filled to minimize turbulence and aeration, and were absolutely free of bubbles, with no headspace.

- Placed the properly labeled and sealed sample containers in a cooler with frozen gel ice and maintained at 4°C for the duration of the sampling and transportation period.

- Recorded all sample collection information (e.g., location, sample identification, sample description, depth collected, etc.) in the field logbook or data sheet.

- Followed sample custody and handling procedures as described in Section 2.2.3, Sample Custody.

- Decontaminated all surface water sampling equipment between sample locations.

- Placed a labeled survey marker identifying the surface water sampling location prior to leaving.

Wipe Samples: A wipe sample was collected from the concrete transformer pad where transformers were once operated. Pre-formed, decontaminated 10- by 10-centimeter (cm) wire templates were used to mark the sampling location. The 100-square-cm area inside the template was swabbed with gauze saturated in hexane. Decontaminated forceps were used to manually swab the template. The sample location was then outlined and permanently marked with the Sample ID immediately following sample collection. Wipe samples were documented on the surface soil/sediment field form and submitted for PCB analysis only.

2.2.1.8 Sample Handling

Samples were shipped once a day from Tin City to the analytical laboratory.

All samples were packaged carefully to avoid breakage or contamination, and were shipped to the laboratory at proper temperature. The following sample packaging requirements were followed:

- Sample bottle lids were not mixed; all sample lids stayed with the original containers.

- All sample bottles were wrapped in bubble pack bags or similar material and placed in plastic ziplock bags to minimize the potential for breakage or cross-contamination during shipment.

- Samples from different sites were not intermingled in a single ziplock bag or within each large trash bag.

- Samples were cooled, unless "no cooling" was specified. The sample containers were packed in a chilled cooler. Empty space in the cooler was filled with inert packing material. Under no circumstances was locally obtained material (sawdust, sand, newspaper, etc.) used.

- The COC were placed in a plastic bag and taped to the inside of the cooler lid.

- All coolers were custody sealed and taped with filament tape for shipment to the laboratory.

Sample Custody: The documentation procedures described in the following sections were implemented during the collection, storage, packing, and shipping of all environmental samples.

A sample was considered under proper custody if:

- It was in actual possession of the responsible person.
- It was in view, following physical possession.

- It was in the possession of a responsible person and was locked or sealed to prevent tampering.
- It was in a secure area.

Sample Labeling: Each sample collected was assigned a unique alpha-numeric identifier code by the field crew to track samples through all phases of the Tin City RI/FS. This numbering system allows the field team to easily catalog all samples collected and provides an accurate means for database manipulation after the field investigation is completed.

Samples were tracked using a sample label which includes the following information:

- Project identifier and project number
- Sample designation (number)
- Date and time of sample collection
- Initials of the sampler
- Analyses to be performed on the sample
- Preservative used, if any

Labels were affixed and covered with clear tape to the glass jars, plastic, or any other containers used to contain samples.

Chain-of-Custody: Sample custody was maintained by a COC record. The custody record was completed by the individual collecting the sample. COC records were completed for samples collected for chemical analyses and for samples collected for geotechnical analyses. The COC is detailed as follows:

- The COC is a continuously maintained custody record that travels with the samples at all times.

- The COC must be signed off by each person responsible for shipping or otherwise relinquishing the samples to an outside laboratory or other agency.

- The COC always includes the following:

  - Corporate name
  - Sampler name and signature
  - The site designation
  - Sample designations
  - Sampling date
  - Sample collection times
  - Analyses to be conducted on the samples
  - Number of containers submitted for each sample set

Sample Storage: Protocols for handling and storing soil and water samples used in the field are detailed in the sections of this document that pertain to field sampling procedures.

- When samples were returned to the field office at the conclusion of sampling they were usually prepared for shipment to the analytical laboratory the next day. The shipping schedule did not allow the samples to be held at an intermediate airport over a weekend.

- Each ice chest contained at least one temperature blank prepared following procedures discussed in the Tin City Sampling and Analysis Plan (EA 1995).

- A sample shipping notebook was kept at the site by the Field Operations Manager. This notebook is a permanent record of the samples stored or shipped from the site.

- When preparing samples for shipment, the following were recorded in the sample shipping notebook:

  - Time
  - Date
  - Sample IDs
  - Laboratory to which they are being shipped

- Initialed all notebook entries.

- When preparing stored samples for shipping, the ice chest was repacked with fresh gel ice and the temperature was checked and recorded in the sample shipping notebook.

Sample Packing:

- Nitrile liners were worn when handling any sample containers or packing the coolers.

- Container labels were checked against the COC to make sure there are no discrepancies and both the labels and the COC were complete and legible.

- Containers were counted to make sure the number was recorded correctly on the COC.

- Bottle caps were checked to make sure they were on tightly.

2.2.1.9 Record Keeping

The field team leader (FTL) maintained a bound field notebook, chain-of-custody (COC) binder, a master log binder, and sample plan checklist. The project laboratory was notified by fax each time a sample shipment left the Tin City site. The air bill and laboratory fax cover sheets were attached to the appropriate COC. All field sampling information was recorded on the appropriate field note form by the sampler, reviewed by the FTL for completeness, and filed into the master log binder at the end of each field day. Equipment calibration information was recorded on the daily QA/QC report, which was faxed to the Program Manager and filed in the master log binder.

Completed daily tailgate safety meeting and Health and Safety Plan (HSP) personnel acknowledge forms were filed with a copy of the HSP.

At the beginning of each sampling event, the FTL proposed a work/sampling schedule which would allow for flexibility and cost effective management of required tasks. This proposed schedule was posted on the field staging area wipe board. The schedule was created to allow any field team member to continue other required program tasks if unforeseen delays occurred, i.e., equipment failure, unavailable personnel, or a delay in permit issuance.

2.2.1.10 Field Team Members

The Tin City RI/FS field team is listed below and described in the following paragraphs.

Field Oversight, AFCEE	Tim Hansen Bret Berglund
Drilling, AF 611th	Mark Mobley, Supervisor Eddie Miles, Helper Chris Bostick, Helper
Field Team Members, Contractor	Bonnie McLean, FTL, OSO, Sample Custodian John DeGeorge, Geologist Doug Quist, Field Chemist

Field Team Leader: Bonnie McLean was the FTL for the Tin City LRRS RI/FS and was responsible for all mobilization/demobilization logistics as well as all field operations conducted during the investigation, including subcontractor oversight. She was responsible for the proper implementation of the SAP and will correct project and/or safety deficiencies identified in the field. Ms. McLean reported directly to Deb Luper, Project Manager.

On-Site Safety Officer: Bonnie McLean was the On-Site Safety Officer for the Tin City LRRS RI/FS and was responsible for the oversight and proper implementation of the HSP. She established the control zones for each field activity, and had the authority to temporarily suspend on-site operations if imminent health hazards were identified.

2.2.2 Chronology of Field Work

Table 2-4 provides a chronology of field work accomplished at Tin City LRRS.

Deviations from the Work Plan are briefly described on Table 2-5. All deletions or additions that occurred during the 1995 field event were recommended and/or approved by the AF on-site personnel. Changes were made to better meet the objectives of the field program.

2.2.3 Field Quality Assurance/Quality Control

2.2.3.1 QA/QC Program Description

Field procedures followed AFCEE QA/QC guidance.

- All sampling and drilling locations were directed and/or approved by AF on-site AFCEE project representatives.

- Daily equipment rinsate samples were completed as directed by the program SAP. Field work was scheduled such that all work requiring the same type of sample equipment was completed on the same day. This resulted in fewer sample sets to complete over the length of the program.

- The only duplicate sample collected was of surface water. No monitoring wells were constructed, therefore, no groundwater samples were collected.

- A background wipe and blank wipe sample were collected for the PCB analysis.

- The staging area was arranged to prevent cross-contamination from any volatile organic source, i.e., gas, hexane, methanol, and empty sample bottles, DI water, or completed samples. All completed samples were ready for shipment at the end of each field day, placed in a refrigerator, and locked.

The field QA/QC program was conducted according to the protocol listed below, as outlined in the Sampling and Analysis Plan (EA 1995).

QC sampling was conducted to ensure the reliability of project samples and usefulness of the analytical data. All QC samples were collected as described in the Tin City Sampling and Analysis Plan (EA 1995). Any minor field changes to the QC sampling procedures were documented in the field logbook. Modifications of the QC sampling procedures were approved by the Field Operations Manager, and USAF prior to implementation of the change. QC sampling procedures are detailed below.

Trip Blanks: One trip blank set accompanied every shipment or cooler of environmental samples sent to the analytical laboratory for the analysis of VOCs. Trip blanks were prepared using the following procedures:

- Trip blanks consisted of three sealed 40-ml VOC sample bottles filled at the analytical laboratory with Type II Reagent Grade Water. The sealed trip blanks accompanied the routine sample containers from the laboratory to the field, during sample collection, and during transport of the samples back to the analytical laboratory.

- Trip blanks were analyzed for VOCs at the laboratory in conjunction with the associated field samples.

Temperature Blanks: One temperature blank accompanied every ice chest containing soil and water samples sent to the laboratory for chemical analysis. Temperature blanks were prepared and evaluated using the following procedures:

- The temperature blanks consisted of one plastic 60-ml container filled with Type II Reagent Grade Water and were labeled temperature blanks.

- The sealed temperature blanks accompanied the routine sample containers during shipment from the field to the analytical laboratory.

- The temperature in the ice chest was checked by opening one of the temperature blanks and inserting a thermometer or thermocouple probe in the water. This provided a much more representative sample temperature than the air temperature in the ice chest.

Equipment Rinsate Blanks: One equipment rinsate blank sample was collected daily for each type of sampling equipment used in this program, according to the following procedures:

- Equipment rinsate blanks were collected by pouring Type II Reagent Grade Water directly over decontaminated sample collection equipment and into the sample containers.

- The equipment rinsate blanks were labeled and transported to the analytical laboratory.

- The equipment rinsate blanks were analyzed for the same analytes as were specified for the associated field samples collected that day.

Field Duplicate and Replicate Samples: One field duplicate water sample was collected. The duplicate sample was collected using the following procedures:

- Field duplicate water samples are obtained when two samples are collected independently at the same sample location during a discrete sampling event. Field duplicate water samples were collected by alternately filling both sample bottles for each analyte from the surface water body (for surface water samples).

- Field duplicate water samples were labeled such that laboratory personnel were unable to distinguish them from the associated field sample.

- Care was exercised to document the association between each duplicate sample and the corresponding field sample, and to correctly record their sample designations in the field logbook.

- The field duplicate water sample was transported to the analytical laboratory using the procedures discussed in the Tin City Sampling and Analysis Plan (EA 1995).

- The field duplicate water sample was analyzed for the same analytes as were specified for the associated field samples.

Control Parameters: The following chemical/physical parameters were measured at Tin City LRRS. The stock solutions of standard materials were obtained from the instrument manufacturer, or a comparable, reliable vendor.

- Temperature
- pH
- Conductivity
- Volatile Hydrocarbons by PID

Corrective Action: Any problems and associated corrective action were noted in the appropriate field instrument logbook, and the Daily Quality Control Report.

All original data recorded in field logbooks, on sample tags, or in custody records, as well as other data sheet entries, were written with waterproof ink. If an error was made on the document or in the logbook, corrections were made simply by crossing a line through the error in such a manner that the original entry could still be read, and the correct information added as the change. All corrections were initialed by the author and dated.

Some initial samples arrived at the laboratory at elevated temperatures. These samples were discarded and replacement samples were collected and analyzed. All replacement samples met temperature requirements.

2.3 LABORATORY ANALYSIS

2.3.1 Analytical Program

Environmental samples collected for the Tin City RI/FS were analyzed between July 19 and August 14 by EA Laboratories in Sparks, Maryland. Eighty-eight soil, six sediment, ten water, and four wipe primary samples (including one background blank and one solvent blank) were analyzed by the methods specified in the Work Plan and documented in the Data Validation Report (Appendix L). Appendix G lists analysis parameters for each sample.

USEPA methods (denoted by SW) are from Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW846), Third Edition, Revision 1 (11/90). Methods with an "AK" prefix in the method number are from the ADEC Underground Storage Tank Removal Program.

Alaska methods AK 101, AK 102, and AK 103 were employed for TPH-gasoline range, TPH-diesel range, and TPH-residual range, respectively.

Summaries of Modified methods are presented below:

Ethylene Glycol: USEPA Method SW8015A was modified for direct injection of water samples into the gas chromatograph, followed by flame ionization detection. Soil samples were mixed 1:3 with Type II water, followed by vortex mixing. The aqueous extract is then treated in the same manner as a water sample.

TPH-Gasoline Range: TPH-gasoline range was analyzed according to AK 101, without modification. However, for the Tin City RI/FS, the described soil collection procedure was modified to exclude methanol preservation in the field. Soil samples for TPH-gasoline range analysis were collected and extracted according to SW846 method 5030.

2.3.2 Chronology of Laboratory Analyses

Table 2-6 summarizes the chronology of sample collection date and time, list of analytes, lab number, and chain-of-custody number.

2.3.3 Quality Assurance/Quality Control Program

The laboratory QC program is a systematic process that controls the validity of analytical results by measuring the accuracy and precision of each method and matrix, developing control limits, using these limits to detect anomalous events, and requiring corrective action to prevent or minimize the recurrence of these events. The following sections describe the types of QC samples, methods for establishing control limits, sources of standard materials, and methods for establishing analytical batches. Equations for calculating precision and accuracy summary statistics from the following QC samples and indicators are listed in Appendix L.

2.3.3.1 Laboratory QC Samples

QC samples are a central part of analytical QC. These laboratory generated samples were introduced into the measurement process to monitor various aspects of analytical procedures. Descriptions and frequency of the laboratory QC samples and indicators to be used for the Tin City RI/FS are listed below:

Method Blanks consist of analyte free laboratory grade water, or a purified solid that is carried through the entire sample preparation and analysis scheme in the same manner as environmental samples. The method blank matrix volume or weight is approximately equal to the associated samples. Method blanks, also called reagent or preparation blanks, were used to monitor interferences caused by contaminants introduced by solvents, reagents, glassware, and other processes. A method blank was prepared and analyzed with each batch of samples.

Laboratory Control Samples are an aqueous or solid sample spiked at a known concentration. The sample is then analyzed using the same sample preparation, reagents, and analytical methods employed for environmental samples. Also known as a blank spike, LCSs were prepared from standard materials different from initial calibration standards. LCSs were used to demonstrate that the accuracy and precision of an analytical method, both preparation and analysis, were in-control.

At least one LCS was analyzed with each batch of samples. The percent recovery was calculated, plotted on control charts, and compared to control limits. If the recovery was outside of limits, all samples in the batch were reanalyzed.

For analysis of water by methods SW8260A, SW8020A, and AK 101, the samples were not subjected to any processing steps that are not performed on standards. Consequently, for these

analyses, the LCS and calibration verification standard were the same, and were not separately prepared.

Matrix Spikes were prepared by adding a known amount of analyte to an environmental sample aliquot before sample preparation and analysis. MSs indicate the performance of the entire method in a given matrix. For multi-analyte methods (e.g., SW8270A, SW8260A), the spiked sample was fortified with a representative suite of analytes. MSs were performed in duplicate (MSD) with every batch of samples analyzed.

Duplicate Samples are samples that have been divided into two portions at some step in the measurement process. Each portion is then carried through the remaining steps of the analysis. Replicate samples provide information on the precision of the operations involved. For the Tin City RI, MSs were be analyzed in duplicate for all methods.

Surrogates are organic compounds that are similar to the analytes of interest in chemical composition, extraction characteristics, and chromatography, but are not normally found in environmental samples. These compounds were spiked into all method blanks, standards, samples, and spiked samples prior to purging or extraction in order to monitor the accuracy and precision of individual sample analysis. Surrogates were used in chromatographic analyses only (except for ethylene glycol analysis). Recoveries must fall within the control limits specified for the program, but were not calculated if sample dilution caused the surrogate concentration to fall below the quantitation limit.

Continuing Calibration Verification Standards (CCVS) are midrange calibration standards analyzed at a predetermined frequency (usually 1 per 10 samples) to verify instrument calibration during the analysis sequence.

2.3.3.2 Methods for Establishing Control Limits

Control limits were established for surrogates and Laboratory Control Samples (LCSs) from historical laboratory data. These limits were established and plotted on control charts as described in Section 1.9.3.1 of the Project SAP (EA 1995). Control limits of $\pm$ 3 standard deviations of the historical mean are used to determine if an analysis is in-control. MS recovery limits were not established for the Tin City RI/FS. Rather, these recoveries were compared to LCS limits. Control limits for other analysis parameters were established by the analytical methods.

Table L-2 of Appendix L summarizes the laboratory QC limits.

2.3.3.3 Sources of Standard Materials

Stock standards were be obtained from the USEPA repository or commercial vendors for the organic compounds. The metal stock solutions were obtained from SPEX, Fisher Scientific, or a comparable, reliable vendor. Stock solutions for surrogate parameters and other inorganic compounds were made up by the analysts from the appropriate reagent grade chemical specified in the procedure. Stock standards were utilized to make intermediate standards of lower concentration, which were then diluted to make calibration standards for the analytical run.

2.3.3.4 Analytical Batches

An extraction batch is defined as the number of samples, including QC samples, that can be processed through the entire preparation procedure during a 24 hour period. For the Tin City RI/FS, no more than 20 samples were included in any batch. At least one method blank, one LCS, and two MSs were included in each batch.

All samples within a batch were processed simultaneously using reagents with the same lot numbers. All analytical batches containing Tin City RI/FS samples used project samples for MS analysis.

2.3.3.5 Corrective Actions

Problems encountered during analysis of Tin City RI/FS samples were primarily due to matrix effects caused by native levels of petroleum present in the samples. For some analyses, matrix effects resulted in elevated surrogate recoveries, depressed internal standard recoveries, and errant matrix spike recoveries. Corrective action for these anomalies consisted of sample dilution or reanalysis. A summary of affected samples and qualified data is contained in Appendix L.

2.3.3.6 Completeness of Analytical Results

Completeness is the number of measurements judged valid, compared to the total number of measurements anticipated. Completeness was calculated as the number of valid measurements reported, divided by the total number requested from the laboratory, expressed as a percentage. In cases where an analytical method measures multiple individual analytes, the criteria apply to each analyte.

The completeness goal for all analyses is 90% for both water and solid matrices. This goal was met with 100% of all analyses completed, except for semivolatile organics and chromium in soil. Completeness for these parameters was calculated at 98% and 95%, respectively.

2.3.4 IRA Data

QA/QC and data validation measures on data collected by ACCI, Inc., during the IRA are described in the final report on the IRA.

2.4 DATA EVALUATION

Laboratory- and field-generated data were reviewed by the project Quality Assurance Officer for adherence to the project data quality objectives (DQOs) and quality control parameters identified in the Tin City Draft Final Sampling and Analysis Plan [SAP (EA 1995)]. Appendix L contains the data validation summary.

Based on data review findings, project data were either reported with out qualification, or with appropriate flags assigned. Data validation guidelines contained in "National Functional

Guidelines for Organic and Inorganic Data Review" (EPA 1994), and the specifications listed in the Air Force Center for Environmental Excellence (AFCEE) Handbook (AFCEE 1993) were followed. Where appropriate and necessary, professional judgment, rather than predetermined criteria were used to determine data qualifiers. In these cases, decisions are noted with justification.

2.4.1 Methodology for Data Quality Assessment

As specified in the project SAP, sample results, summary quality control (QC) results, and supporting documentation were reviewed for all samples. These review items include:

1. Case Narrative

    - Analytical Narrative
    - Analytical Methods
    - Data Qualifiers
    - Summary Data Tables

2. Chain-of-Custody

3. Sample Data

    - Sample Results (including field blanks)
    - Chromatographic Pattern Interpretation (TPH-diesel range, TPH-gasoline range, and TPH-residual range)
    - QC Summary
        - method blank results
        - matrix spike/duplicate matrix spike recoveries
        - surrogate recoveries
        - GC/MS tuning summary
        - internal standard area summary
        - PQLs
        - initial calibration summary
        - continuing calibration verification summary
        - LCS recoveries

Raw data for all aspects of sample analysis, including those mentioned above, were reviewed for approximately ten percent of project samples.

The following field data checks were performed:

- Completeness of field records
- Identification of valid results
- Correlation of field test data
- Identification of anomalous field test data
- Assessment of the accuracy and precision of the field test data and measurements

Field measurements included screening of samples for organic vapors using a photoionization detector (PID), and water quality measurements associated with surface-water sample collection. Other field measurements identified in the project Work Plan were omitted from the scope of work by the on-site AFCEE representative.

A check of field record completeness found that all requirements for field activities in the SOW have been fulfilled, complete records exist for each field activity, and the procedures specified in the program planning documents have been implemented. As described above, an assessment of the precision and accuracy of the field data was made, based on calibration records, and daily quality control records. No anomalies were found with any data.

Based on the information reviewed, the Tin City RI/FS data are judged to be valid and meet the project objectives.

2.4.2 Data Analysis and Interpretation

2.4.2.1 Review of Selected Analytical Methods

Analytical methods were reviewed for accuracy, completeness, and precision by the Montgomery Watson project chemist and the data were qualified accordingly based on the system outlined in the project Sampling and Analysis Plan. A summary of the data validation is included in this document as Appendix L. Based on the results of the data validation, the Tin City 1995 data are judged to be valid and meet the project objectives.

2.4.2.2 Review of Calculations

Field data, including field note forms, field checklists, chain-of-custody forms, and field daily reports (Appendices D and F) were reviewed prior to inclusion in the database and reports. Laboratory data were checked for accuracy, completeness, and consistency. Risk assessment calculations were reviewed and checked by the Project Manager prior to compilation and reporting.

2.4.2.3 Review of the Conceptual Site Model

The conceptual site model, including the geologic and hydrologic environment, was reviewed at the briefing meeting with the AFCEE/11611th representatives on September 22, 1995 and has remained unchanged.

Figure 2-2 illustrates the Conceptual Site Model and shows the potential source areas, release mechanism, potentially affected media, potential exposure route, and potential receptors. As shown in the model, exposure is limited to contact of humans and wildlife with surface soils, and ingestion of surface water by wildlife. These pathways were evaluated in the risk assessment.

2.4.2.4 Review of Illustrations

The illustrations, map cross-sections, and all figures and diagrams were reviewed for accuracy, completeness, and consistency of terminology. Data were reviewed and compared against the original data source.

3.0 REMEDIAL INVESTIGATION

3.1 REMEDIAL INVESTIGATION RESULTS

3.1.1 Background

Table 3-1 shows the background concentrations of metals, pesticides and PCBs in soils, stream and ocean sediments that have been documented in individual samples during previous investigations. Three additional background soils were collected during the 1995 investigation. Figure 3-1 shows the sampling locations, and Table 3-2 presents the results. For evaluation purposes, concentrations of metals falling below the concentrations detected in individual background samples were considered to be comparable to background.

The background soil samples exhibit enriched metals concentrations as would be expected in a mining area. The veins with enriched-metals concentrations prompted mining of the area and is the source of the installation name, Tin City. Mining activities tend to transfer metals from the subsurface and release them at the surface. No records indicate any involvement of the Air Force in the mining activities around Tin City.

Detectable levels of PCBs were detected in one background soil sample. Elevated levels of PCBs have been detected in background samples throughout the arctic and are attributed in part to aerial deposition of PCBs carried long distances (Norstrom 1994).

Concentrations of TPH-diesel range were detected in one sample above the most stringent ADEC cleanup levels. It is likely that the naturally-occurring organic materials such as peat are the source. Delineation of petroleum contamination in the tundra, such as DP 011b, may be complicated by interferences due the naturally-occurring organics.

3.1.2 Regulatory Benchmarks

Table 3-3 presents the conservative regulatory benchmarks documented in the Work Plan for use in eliminating from further consideration, situations that present minimal risk to human health or the environment under foreseeable circumstances. Many of the IRP Source Areas and AOC consisted of areas with detectable levels of TPH-diesel range and TPH-gasoline range in unsaturated soil. In these cases, the cleanup criteria in the State of Alaska Oil and Hazardous Substances Regulations (18 AAC 75) and Underground Storage Tank Regulations (18 AAC 78) were selected as appropriate regulatory benchmarks.

The regulations state that the site be remediated to the satisfaction of the regulator. Specific numerical cleanup levels are suggested only in the companion guidance documents, *Interim Guidelines for Non-UST Contaminated Soil Clean-Up Levels* (ADEC 1991a) and *Guidance Manual for Underground Storage Tank Regulations* (ADEC 1993c). In both cases, ADEC provides a system to score sites based on five site-specific criteria, namely:

- Depth to subsurface water

- Mean annual precipitation
- Soil type
- Potential receptors
- Volume of contaminated soil

The score, called the matrix score, is used to classify the site into one of four levels, A through D, with specific estimated numerical cleanup levels for TPH-diesel range, TPH-gasoline range, total BTEX, and benzene in soil. Level A has the most stringent estimated cleanup levels and Level D has the least stringent.

If an area does not exceed the site-specific numerical cleanup level, the site is generally recognized as requiring no further action.

If an area exceeds the site-specific numerical cleanup levels, ADEC recognizes that addition site-specific factors, such leachability, the absence of risk drivers, and receptors, will allow selection of cleanup levels above the cleanup matrix levels that meet the regulatory objective of protection of human health and the environment.

The most stringent ADEC soil cleanup levels (ADEC 1991a) were identified as conservative benchmarks for the concentrations of petroleum constituents in soil. Alaska state and federal drinking water criteria were identified for as conservative benchmarks for surface water, even though the surface water in the areas under investigation is not used as a drinking water source.

3.1.3 DP 011a Data Summary

Primary source: Dump #3 at beach which consists of abandoned drums and machinery in ponded surface water. All drums were removed from the site during the 1995 removal action performed by ACCI, Inc. Figure 3-2 shows the IRP Source Area.

Background and excluded constituents: Metals concentrations in sediments are comparable to background levels shown in Tables 3-1 and 3-2 . Naturally-occurring organics that settle out over time from the ponded water may be contributing to the elevated levels of TPH-diesel range.

Primary contaminants by media: Minimal concentrations of TPH-diesel range (60-410 mg/kg) were detected in three sediment samples and are below the site-specific ADEC cleanup matrix levels. Arsenic was detected (3.3-7.5 mg/kg) in all three sediment samples at levels comparable to the documented site background levels (Tables 3-1 and 3-2). BTEX constituents were not detected in any samples suggesting natural attenuation is taking place. Minimal TPH-diesel range (ND-210 ug/L) and arsenic (ND-1.4 ug/L) were detected in surface water. Table 3-4 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): Conservatively estimated as 90,000 square feet of ponded surface water and sediments on average.

Estimated total depth (feet): 1

Estimated volume (cubic yards): 3,300 (based on ADEC matrix level A)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on very limited number of samples
2. Elevated levels of constituents may extend beyond the sampled locations and to greater depths
3. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: Yes

Trends: No historical data available.

Media type: Ponded surface water and sediments.

Potential receptors: Humans and wildlife in contact with surface water and sediments. Tundra, Bering Sea.

ADEC matrix level: C

Note: IRP site DP 011b is summarized separately in the next section.

IRP SOURCE AREA: DP 011a

1.	Depth to Subsurface Water		
	<5 feet	(10)	10
	5 - 15 feet	(8)	
	15 - 25 feet	(6)	
	25 - 50 feet	(4)	
	>50 feet	(1)	
2.	Mean Annual Precipitation		
	>40 inches	(10)	
	25 - 40 inches	(5)	
	15 - 25 inches	(3)	
	<15 inches	(1)	1
3.	Soil Type		
	clean, coarse-grained soils	(10)	
	coarse-grained soils with fines	(8)	
	fine-grained soils (low organic carbon)	(3)	3
	fine-grained soils (high organic carbon)	(1)	
4.	Potential Receptors		
	public well within 1,000 feet, or private well(s) within 500 feet	(15)	
	municipal/private well within 1/2 mile	(12)	
	municipal/private well within 1 mile	(8)	
	no known well within 1/2 mile	(6)	
	no known well within 1 mile	(4)	
	non-potable groundwater	(1)	1
5.	Volume of Contaminated Soil		
	>500 cubic yards	(10)	10
	100 - 500 cubic yards	(8)	
	25 - 100 cubic yards	(5)	
	>De Minimis - 25 cubic yards	(2)	
	De Minimis	(0)	

Matrix Score	25
Level	C

		Cleanup Level Estimate in mg/kg			
		Diesel	Gasoline/Unknown		
Matrix Score		Diesel-Range Petroleum Hydrocarbons	Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.4 DP 011b Data Summary

Primary source: Nine areas with abandoned drums and one drum crushing pad. The areas are identified by ACCI, Inc. as the Eastern Drum Area, Central Drum Area; Western Drum Area; Sub B Drum Area; Sub D Drum Area; Crushed Drum Pile A; Crushed Drum Pile B; and Crushed Drum Pile C, and Drum Crushing Pad. Figure 1-8 shows the IRP Source Area. Additional detail is shown on Figures 1-9 through 1-19.

Background and excluded constituents: Elevated levels of TPH-diesel range and TPH-gasoline range were detected in background samples of tundra and peat and may be contributing to the elevated levels detected in these samples due to naturally-occurring organic materials, especially since the soil samples were collected in tundra areas. Defining the extent of contamination may be complicated by the contributions of the naturally-occurring organics and should be considered during the planning phases of any removal action.

Primary contaminants by media: TPH-residual range (ND-131,000 mg/kg), TPH-diesel range (ND-160,000 mg/kg), and TPH-gasoline range (ND-450 mg/kg) at elevated levels in isolated areas of tundra. The analytical results showed elevated levels of petroleum hydrocarbons in the Eastern Drum Area, Central Drum Area; Western Drum Area; Sub B Drum Area; Sub D Drum Area; Crushed Drum Pile B; and Crushed Drum Pile C. Elevated levels of petroleum hydrocarbons were not detected at the Crushed Drum Pile A and Drum Crushing Pad. Tables 1-2 through 1-9 presents a summary of the detected constituents.

Estimated areal extent (square feet): 9,050

Estimated total depth (feet): 1-4 feet depending on the specific isolated area

Estimated volume (cubic yards): 880 (based on ADEC level A matrix)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume should be used only as very rough numbers because:

1. Based on a very limited number of samples
2. Contamination may extend beyond sampling points
3. Areal extent based on visual indications of stained soil.
4. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional services.

Surface contamination: Yes

Trends: No historical data are available for this area.

Media type: Unknown, suspected tundra mat.

Potential receptors: Humans and wildlife in contact with surface soils. Tundra.

ADEC Matrix Level: C

IRP SOURCE AREA: DP 011b

1.	Depth to Subsurface Water		
	<5 feet	(10)	10
	5 - 15 feet	(8)	
	15 - 25 feet	(6)	
	25 - 50 feet	(4)	
	>50 feet	(1)	
2.	Mean Annual Precipitation		
	>40 inches	(10)	
	25 - 40 inches	(5)	
	15 - 25 inches	(3)	
	<15 inches	(1)	1
3.	Soil Type		
	clean, coarse-grained soils	(10)	
	coarse-grained soils with fines	(8)	
	fine-grained soils (low organic carbon)	(3)	3
	fine-grained soils (high organic carbon)	(1)	
4.	Potential Receptors		
	public well within 1,000 feet, or private well(s) within 500 feet	(15)	
	municipal/private well within 1/2 mile	(12)	
	municipal/private well within 1 mile	(8)	
	no known well within 1/2 mile	(6)	
	no known well within 1 mile	(4)	
	non-potable groundwater	(1)	1
5.	Volume of Contaminated Soil		
	>500 cubic yards	(10)	10
	100 - 500 cubic yards	(8)	
	25 - 100 cubic yards	(5)	
	>De Minimis - 25 cubic yards	(2)	
	De Minimis	(0)	

Matrix Score 25

Level C

Matrix Score		Cleanup Level Estimate in mg/kg — Diesel: Diesel-Range Petroleum Hydrocarbons	Gasoline/Unknown: Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.5 AOC 1 Data Summary

Primary source: Spill/Leak #5 at the Fuel Pump House (Bldg. 123). The pump house has been taken out of service and all stored fuel removed. Figure 3-2 shows the Area of Concern.

Background and excluded constituents: Lead levels in soil (<10 mg/kg) are comparable to site background levels (Tables 3-1 and 3-2) suggesting that the lead is naturally occurring and not due to leaded fuel products.

Primary contaminants by media: TPH-diesel range (44-8,600 mg/kg) and TPH-gasoline range (ND-120 mg/kg) were detected in the gravel pad and sediments associated with surface water. TPH-diesel range (1,800-9,000 ug/L) in ponded surface water. Little correlation exists between the relative amounts of TPH-diesel range and TPH-gasoline range suggesting that there were several isolated releases of petroleum constituents over time. No benzene was detected and only minimal amounts of other BTEX constituents (ND-51 ug/L) were found suggesting that natural attenuation is taking place.

Table 3-5 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): 13,000

Estimated total depth (feet): 1 (based on drilling experience during investigation where rock was encountered at depths of about 1.0 foot.)

Estimated volume (cubic yards): 480 (based on ADEC matrix level A)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on limited number of samples
2. Contamination may extend beyond the sampled locations
3. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: Yes

Trends: No historical data

Media type: Gravel, sediment, and surface water

Potential receptors: Humans and wildlife in contact with soils, sediments, and surface water. Potential surface migration toward the Bering Sea

ADEC Matrix Level: B

IRP SOURCE AREA: AOC 1

1. Depth to Subsurface Water		
<5 feet	(10)	10
5 - 15 feet	(8)	
15 - 25 feet	(6)	
25 - 50 feet	(4)	
>50 feet	(1)	
2. Mean Annual Precipitation		
>40 inches	(10)	
25 - 40 inches	(5)	
15 - 25 inches	(3)	
<15 inches	(1)	1
3. Soil Type		
clean, coarse-grained soils	(10)	
coarse-grained soils with fines	(8)	8
fine-grained soils (low organic carbon)	(3)	
fine-grained soils (high organic carbon)	(1)	
4. Potential Receptors		
public well within 1,000 feet, or private well(s) within 500 feet	(15)	
municipal/private well within 1/2 mile	(12)	
municipal/private well within 1 mile	(8)	
no known well within 1/2 mile	(6)	
no known well within 1 mile	(4)	
non-potable groundwater	(1)	1
5. Volume of Contaminated Soil		
>500 cubic yards	(10)	
100 - 500 cubic yards	(8)	8
25 - 100 cubic yards	(5)	
>De Minimis - 25 cubic yards	(2)	
De Minimis	(0)	

Matrix Score 28

Level B

Matrix Score		Cleanup Level Estimate in mg/kg: Diesel — Diesel-Range Petroleum Hydrocarbons	Gasoline/Unknown — Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.6 ST 12a Data Summary

Primary source: UST #3 (removed) at Power Plant (Bldg. 110). Figure 3-3 shows the IRP Source Area.

Background and excluded constituents: Metals were detected at concentrations comparable to the site background levels shown on Tables 3-1 and 3-2.

Primary contaminants by media: TPH-diesel range (10-3,500 mg/kg) and TPH-gasoline range (ND-11,000 ug/kg) subsurface in the gravel pad above the site-specific ADEC matrix levels. BTEX (ND-142 ug/kg) was detected subsurface in the gravel pad below ADEC matrix levels. Benzene is absent, while other BTEX constituents are present at only at minimal levels suggesting that natural attenuation is occurring. Table 3-6 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): 1,200 (based on an extrapolation of the analytical results)

Estimated total depth (feet): 6 (on average, based on drilling experience during the investigation where boulders/bedrock was encountered at 6 feet bgs)

Estimated volume (cubic yards): 270 (based on ADEC level A matrix). 70 (based on site qualifying as ADEC matrix level C)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on very limited number of samples
2. Contamination may extend beyond sampling points
3. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: No

Trends: No trends can be discerned since comparable locations were not sampled

Media type: Silty sand with gravel

Potential receptors: None

ADEC matrix level: C

IRP SOURCE AREA: ST 12a

1.	Depth to Subsurface Water		
	<5 feet	(10)	
	5 - 15 feet	(8)	
	15 - 25 feet	(6)	
	25 - 50 feet	(4)	
	>50 feet	(1)	1
2.	Mean Annual Precipitation		
	>40 inches	(10)	
	25 - 40 inches	(5)	
	15 - 25 inches	(3)	
	<15 inches	(1)	1
3.	Soil Type		
	clean, coarse-grained soils	(10)	10
	coarse-grained soils with fines	(8)	
	fine-grained soils (low organic carbon)	(3)	
	fine-grained soils (high organic carbon)	(1)	
4.	Potential Receptors		
	public well within 1,000 feet, or private well(s) within 500 feet	(15)	
	municipal/private well within 1/2 mile	(12)	
	municipal/private well within 1 mile	(8)	
	no known well within 1/2 mile	(6)	
	no known well within 1 mile	(4)	
	non-potable groundwater	(1)	1
5.	Volume of Contaminated Soil		
	>500 cubic yards	(10)	
	100 - 500 cubic yards	(8)	8
	25 - 100 cubic yards	(5)	
	>De Minimis - 25 cubic yards	(2)	
	De Minimis	(0)	

Matrix Score 21

Level C

Matrix Score		Cleanup Level Estimate in mg/kg: Diesel — Diesel-Range Petroleum Hydrocarbons	Gasoline/Unknown — Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.7 ST 12b Data Summary

Primary source: UST #20 (removed) at Composite Building (Bldg. 150). Figure 3-4 shows the IRP Source Area.

Background and excluded constituents: Metals, including arsenic, are present in gravel pad at concentrations comparable to site background levels presented in Tables 3-1 and 3-2.

Primary contaminants by media: Historical TPH-diesel range levels (11-3,721 mg/kg) exceed ADEC matrix levels. Current TPH-diesel range levels (15-120 mg/kg) in gravel pad are well below the site-specific ADEC matrix levels. No BTEX constituents detected in current samples. Table 3-7 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): 400 (based on soil staining and extrapolation of sampling results)

Estimated total depth (feet): 5 (average based on drilling gravel pad experience during investigation where boulders/bedrock was encountered)

Estimated volume (cubic yards): 75 (based on ADEC level A matrix), 40 (based on site qualifying as ADEC matrix level D)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on very limited number of samples

Surface contamination: No

Trends: No trends could be discerned since comparable locations were not sampled during past investigations.

Media type: Sand and gravel

Potential receptors: Humans and wildlife in contact with surface soils

ADEC matrix level: D

IRP SOURCE AREA: ST 12b

1. Depth to Subsurface Water		
<5 feet	(10)	
5 - 15 feet	(8)	
15 - 25 feet	(6)	
25 - 50 feet	(4)	
>50 feet	(1)	1
2. Mean Annual Precipitation		
>40 inches	(10)	
25 - 40 inches	(5)	
15 - 25 inches	(3)	
<15 inches	(1)	1
3. Soil Type		
clean, coarse-grained soils	(10)	
coarse-grained soils with fines	(8)	8
fine-grained soils (low organic carbon)	(3)	
fine-grained soils (high organic carbon)	(1)	
4. Potential Receptors		
public well within 1,000 feet, or private well(s) within 500 feet	(15)	
municipal/private well within 1/2 mile	(12)	
municipal/private well within 1 mile	(8)	
no known well within 1/2 mile	(6)	
no known well within 1 mile	(4)	
non-potable groundwater	(1)	1
5. Volume of Contaminated Soil		
>500 cubic yards	(10)	
100 - 500 cubic yards	(8)	
25 - 100 cubic yards	(5)	5
>De Minimis - 25 cubic yards	(2)	
De Minimis	(0)	

Matrix Score 16

Level D

Matrix Score		Cleanup Level Estimate in mg/kg: Diesel — Diesel-Range Petroleum Hydrocarbons	Gasoline/Unknown — Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.8 SS 13a Data Summary

Primary source: Stained soils from spill/leak #3 at lower tram from a single buried drum discovered in 1993 by a contractor. Extent of TPH-diesel range suggests the source would be larger than a single drum and may include historical releases from other unidentified sources, such as the adjacent above-ground fuel storage tank. The absence of significant BTEX constituents suggests there is no significant on-going source and natural attenuation is occurring. Figure 3-5 shows the IRP Source Area.

Background and excluded constituents: Metals were detected at levels comparable to the site-specific background levels. A single detection of bis(2-ethylhexyl)phthalate is likely due to the sample bottle. Some low levels of solvents (tetrachloroethene) and 1,3,5-Trimethylbenzene present in isolated samples at levels comparable to the regulatory benchmarks identified in Table 3-3.

Primary contaminants by media: TPH-diesel range (13-5,400 mg/kg) and arsenic (ND-3.3 mg/kg) were detected in the sand/gravel pad. TPH-gasoline range (ND-75 mg/kg) was detected below the most stringent ADEC matrix levels. Table 3-8 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): 2,800 (based on the extent of soil staining and extrapolations of the analytical results)

Estimated total depth (feet): 4 (an average, based on drilling gravel pad experience during investigation where boulders/bedrock was encountered)

Estimated volume (cubic yards): 415 (based on ADEC level A matrix)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on very limited number of samples
2. Contamination may extend beyond the sampled locations
3. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: Yes

Trends: No historical data available.

Media type: Sand and gravel

Potential receptors: Humans and wildlife in contact with surface soils.

ADEC matrix level: C

IRP SOURCE AREA: SS 13a

1.	Depth to Subsurface Water		
	<5 feet	(10)	
	5 - 15 feet	(8)	
	15 - 25 feet	(6)	
	25 - 50 feet	(4)	
	>50 feet	(1)	1
2.	Mean Annual Precipitation		
	>40 inches	(10)	
	25 - 40 inches	(5)	
	15 - 25 inches	(3)	
	<15 inches	(1)	1
3.	Soil Type		
	clean, coarse-grained soils	(10)	10
	coarse-grained soils with fines	(8)	
	fine-grained soils (low organic carbon)	(3)	
	fine-grained soils (high organic carbon)	(1)	
4.	Potential Receptors		
	public well within 1,000 feet, or private well(s) within 500 feet	(15)	
	municipal/private well within 1/2 mile	(12)	
	municipal/private well within 1 mile	(8)	
	no known well within 1/2 mile	(6)	
	no known well within 1 mile	(4)	
	non-potable groundwater	(1)	1
5.	Volume of Contaminated Soil		
	>500 cubic yards	(10)	
	100 - 500 cubic yards	(8)	8
	25 - 100 cubic yards	(5)	
	>De Minimis - 25 cubic yards	(2)	
	De Minimis	(0)	

Matrix Score 21

Level C

		Cleanup Level Estimate in mg/kg			
		Diesel	Gasoline/Unknown		
Matrix Score		Diesel-Range Petroleum Hydrocarbons	Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.9 SS 13b Data Summary

Primary source: Transformers formerly sited on stained concrete pad. Figure 3-5 shows the IRP Source Area.

Background and excluded constituents: None

Primary contaminants by media: Nanogram levels of PCBs were detected in wipe samples from the concrete pad. No PCBs were detected in soil

Estimated areal extent (square feet): None

Estimated total depth (feet): None

Estimated volume (cubic yards): None

Assumptions/qualifiers for estimated areal extent and volumes: NA

Surface contamination: NA

Potential receptors: Humans and wildlife in contact with the concrete pad.

3.1.10 SS 14a and SS 14b Data Summary

Primary source: (a) Three USTs (removed) near Bldg. 76-200 at SP 4. (b) AST #10 near Bldg. 76-200 at SP 4. These two areas were combined since the sampling and analysis suggested a single area of petroleum contamination, rather than two separate areas. Figure 3-6 shows the IRP Source Area.

Background and excluded constituents: Metals were detected in soils at levels comparable to the site-specific background concentrations. Phthalates were detected in soil samples. It is likely that the phthalates were contributed by the plastic sample bottle, since phthalates are raw materials in plastics and the petroleum products stored in the tanks are unlikely to have contained any phthalates.

Primary contaminants by media: TPH-diesel range (9.0-4,500 mg/kg) was detected in the gravel pad. TPH-gasoline range and BTEX were detected at elevated levels in only one isolated subsurface sampling location suggesting that the extent of TPH-gasoline range and BTEX is limited. Tables 3-9 and 3-10 present a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): 6,500 (based on extrapolation of the limited analytical results)

Estimated total depth (feet): 5.5 (an average based on drilling experience during investigation where boulders/bedrock was encountered at about 5.5 feet bgs)

Estimated volume (cubic yards): 1,350 (based on ADEC level A matrix), 1,000 (Based on site qualifying as ADEC matrix level C)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on limited number of samples
2. Contamination may extend beyond the sampled locations
3. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: No

Trends: No historical data are available for this site

Media type: Sand and gravel

Potential receptors: None

ADEC matrix level: C

IRP SOURCE AREA: SS 14a and b

1. Depth to Subsurface Water		
<5 feet	(10)	
5 - 15 feet	(8)	
15 - 25 feet	(6)	
25 - 50 feet	(4)	
>50 feet	(1)	1
2. Mean Annual Precipitation		
>40 inches	(10)	
25 - 40 inches	(5)	
15 - 25 inches	(3)	
<15 inches	(1)	1
3. Soil Type		
clean, coarse-grained soils	(10)	
coarse-grained soils with fines	(8)	8
fine-grained soils (low organic carbon)	(3)	
fine-grained soils (high organic carbon)	(1)	
4. Potential Receptors		
public well within 1,000 feet, or private well(s) within 500 feet	(15)	
municipal/private well within 1/2 mile	(12)	
municipal/private well within 1 mile	(8)	
no known well within 1/2 mile	(6)	
no known well within 1 mile	(4)	
non-potable groundwater	(1)	1
5. Volume of Contaminated Soil		
>500 cubic yards	(10)	10
100 - 500 cubic yards	(8)	
25 - 100 cubic yards	(5)	
>De Minimis - 25 cubic yards	(2)	
De Minimis	(0)	

Matrix Score	21
Level	C

Matrix Score		Cleanup Level Estimate in mg/kg: Diesel — Diesel-Range Petroleum Hydrocarbons	Gasoline/Unknown — Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.11 AOC 2 Data Summary

Primary source: This AOC consists of two distinct and separate potential sources based on the visual observation of stained soils and the potential sources. The potential sources are discussed separately as a and b. a. Stained soil at door to deactivated sub station (Sample SS I2). b. Tank #8 (AST), which has been removed (Sample SS I1).

Figure 3-5 shows the Area of Concern.

Background and excluded constituents: Lead was detected in soils at levels comparable to the site background levels presented in Tables 3-1 and 3-2.

Primary contaminants by media: a. TPH-diesel range (31 mg/kg) below site-specific ADEC matrix, Aroclor-1254 (ug/kg) and Aroclor-1260 (790 ug/kg). b. TPH-diesel range (1,100 mg/kg) and Aroclor-1254 (1,300 ug/kg).

Table 3-11 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): a. 5. b. 5 (based on visual observation of the extent of stained soils).

Estimated total depth (feet): a. 1. b. 1 (based on the visual extent of stained soils and extrapolation of the analytical results).

Estimated volume (cubic yards): a. Less than 1. b. Less than 1 (based on the visual extent of stained soils and extrapolation of the analytical results).

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on very limited number of samples
2. Contamination may extend beyond the sampled locations
3. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: Yes

Media type: Surface soil sample

Potential receptors: Humans and wildlife in contact with surface soils.

ADEC matrix level: D (applies to petroleum contamination in AOC 2b only).

IRP SOURCE AREA: AOC 2

1.	Depth to Subsurface Water		
	<5 feet	(10)	
	5 - 15 feet	(8)	
	15 - 25 feet	(6)	
	25 - 50 feet	(4)	
	>50 feet	(1)	1
2.	Mean Annual Precipitation		
	>40 inches	(10)	
	25 - 40 inches	(5)	
	15 - 25 inches	(3)	
	<15 inches	(1)	1
3.	Soil Type		
	clean, coarse-grained soils	(10)	
	coarse-grained soils with fines	(8)	8
	fine-grained soils (low organic carbon)	(3)	
	fine-grained soils (high organic carbon)	(1)	
4.	Potential Receptors		
	public well within 1,000 feet, or private well(s) within 500 feet	(15)	
	municipal/private well within 1/2 mile	(12)	
	municipal/private well within 1 mile	(8)	
	no known well within 1/2 mile	(6)	
	no known well within 1 mile	(4)	
	non-potable groundwater	(1)	1
5.	Volume of Contaminated Soil		
	>500 cubic yards	(10)	
	100 - 500 cubic yards	(8)	
	25 - 100 cubic yards	(5)	
	>De Minimis - 25 cubic yards	(2)	
	De Minimis	(0)	0

Matrix Score 11

Level D

Matrix Score		Cleanup Level Estimate in mg/kg: Diesel — Diesel-Range Petroleum Hydrocarbons	Gasoline/Unknown — Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.12 AOC 3 Data Summary

Primary source: An abandoned substation where equipment, such as transformers, may have contained PCB-containing oils. Figure 3-3 shows the Area of Concern.

Background and excluded constituents: Low levels of PCBs detected in one surface soil background sample (of four background samples) and one ocean sediment sample. The single detection of PCBs (Aroclor 1242) in surface soil (3.2 mg/kg) is comparable to typical cleanup levels for PCBs in residential areas, which ranges from 1-10 mg/kg.

Primary contaminants by media: Elevated Aroclor 1242 (3,200 ug/kg) was detected in one isolated soil sample. Elevated TPH-diesel range (5,100 mg/kg) occurred in soil in one isolated area which was not coincident with the Aroclor 1242. Based visual observations on surface soil staining, the two areas are distinct and separated by unstained soils. Therefore the two areas are discussed separately.

Table 3-12 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): a. Petroleum area: 5 (extent based on visual soil staining). b. PCB area: 5 (extent based on visual soil staining)

Estimated total depth (feet): Less than 1 for both areas (based on visual observations of the extent of soil staining)

Estimated volume (cubic yards): Less than 1 for each of the two areas.

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on very limited number of samples
2. Contamination may extend beyond the sampled locations
3. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: Yes

Trends: No historical data are available.

Media type: Surface soils

Potential receptors: Humans and wildlife in contact with surface soils

ADEC matrix level: D (applies only to the petroleum area)

IRP SOURCE AREA: AOC 3a

1.	Depth to Subsurface Water		
	<5 feet	(10)	
	5 - 15 feet	(8)	
	15 - 25 feet	(6)	
	25 - 50 feet	(4)	
	>50 feet	(1)	1
2.	Mean Annual Precipitation		
	>40 inches	(10)	
	25 - 40 inches	(5)	
	15 - 25 inches	(3)	
	<15 inches	(1)	1
3.	Soil Type		
	clean, coarse-grained soils	(10)	10
	coarse-grained soils with fines	(8)	
	fine-grained soils (low organic carbon)	(3)	
	fine-grained soils (high organic carbon)	(1)	
4.	Potential Receptors		
	public well within 1,000 feet, or private well(s) within 500 feet	(15)	
	municipal/private well within 1/2 mile	(12)	
	municipal/private well within 1 mile	(8)	
	no known well within 1/2 mile	(6)	
	no known well within 1 mile	(4)	
	non-potable groundwater	(1)	1
5.	Volume of Contaminated Soil		
	>500 cubic yards	(10)	
	100 - 500 cubic yards	(8)	
	25 - 100 cubic yards	(5)	
	>De Minimis - 25 cubic yards	(2)	
	De Minimis	(0)	0

Matrix Score 13
Level D

		Cleanup Level Estimate in mg/kg			
		Diesel	Gasoline/Unknown		
Matrix Score		Diesel-Range Petroleum Hydrocarbons	Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.1.13 ST 12c Data Summary

Primary source: 4,000-gallon diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132. Figure 3-7 shows the IRP Source Area.

Background and excluded constituents: Background samples of tundra showed slightly elevated levels of TPH-residual range and TPH-diesel range indicating that naturally-occurring organics may be contributing slightly to the elevated levels of TPH-diesel range in the one sediment sample and possibly the two surface water samples. Future studies may want to consider sampling and analysis methods which could minimize the interferences.

Primary contaminants by media: TPH-diesel range (130-24,000 mg/kg), TPH-gasoline range (ND-590 mg/kg), and BTEX (ND-577 ug/kg) were detected in the gravel pad. SVOC are absent except for low levels of 2-methylnaphthalene (26 mg/kg), phenanthrene (0.56 mg/ug), diethyl phthalate (20 ug/L), and 4-methylphenol (19 ug/L), which all occur in isolated locations. The relative levels of TPH-diesel range and TPH-gasoline range in soil samples are not consistent indicating that use of one analytical method as a surrogate for the petroleum contamination may be inappropriate. TPH-diesel range, TPH-gasoline range, ethylbenzene, xylenes and 4-methylphenol are apparently migrating to the surface water and sediment in the adjacent tundra at two distinct locations. No benzene and only minimal amounts of other BTEX constituents were detected. Table 3-13 presents a summary of the detected constituents. Full analytical results are included in Appendix G.

Estimated areal extent (square feet): 11,250 (based on the most stringent ADEC cleanup matrix levels for petroleum constituents)

Estimated total depth (feet): 3 (an average, based on drilling gravel pad experience during investigation where boulders/bedrock was encountered at depths of approximately 3 feet)

Estimated volume (cubic yards): 1,250 (based on ADEC level A matrix)

Assumptions/qualifiers for estimated areal extent and volumes:

Areal extent and volume calculations should be used only as very rough numbers, because:

1. Based on limited number of samples
2. Contamination may extend beyond the sampled locations
3. Contamination may extend to greater depths
4. Collection of additional data is highly recommended prior to using these estimates for budgeting or executing additional activities.

Surface contamination: Yes

Trends: No trends can be discerned since comparable locations were not sampled during past investigations.

Media type: Sand and gravel, sediments, and surface water.

Potential receptors: Humans and wildlife in contact with soils, sediments, water, tundra.

ADEC Matrix Level: B

IRP Source Area: Ss 12c

1.	Depth To Subsurface Water		
	<5 Feet	(10)	10
	5 - 15 Feet	(8)	
	15 - 25 Feet	(6)	
	25 - 50 Feet	(4)	
	>50 Feet	(1)	
2.	Mean Annual Precipitation		
	>40 inches	(10)	
	25 - 40 inches	(5)	
	15 - 25 inches	(3)	
	<15 inches	(1)	1
3.	Soil Type		
	clean, coarse-grained soils	(10)	
	coarse-grained soils with fines	(8)	8
	fine-grained soils (low organic carbon)	(3)	
	fine-grained soils (high organic carbon)	(1)	
4.	Potential Receptors		
	public well within 1,000 feet, or private well(s) within 500 feet	(15)	
	municipal/private well within 1/2 mile	(12)	
	municipal/private well within 1 mile	(8)	
	no known well within 1/2 mile	(6)	
	no known well within 1 mile	(4)	
	non-potable groundwater	(1)	1
5.	Volume of Contaminated Soil		
	>500 cubic yards	(10)	10
	100 - 500 cubic yards	(8)	
	25 - 100 cubic yards	(5)	
	>De Minimis - 25 cubic yards	(2)	
	De Minimis	(0)	

Matrix Score 30

Level B

Matrix Score		Cleanup Level Estimate in mg/kg — Diesel: Diesel-Range Petroleum Hydrocarbons	Gasoline/Unknown: Gasoline-Range Petroleum Hydrocarbons	Benzene	Total BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

3.2 HUMAN HEALTH BASELINE RISK ASSESSMENT

This section presents the baseline human health risk assessment as described in Section 2.4.3, and includes separate subsections describing background data, selection of chemicals of potential concern, exposure assessment, risk characterization, and uncertainty analysis.

3.2.1 Contaminants of Potential Concern

The results of sampling analyses from the 1995 RI are reported in detail in Section 3.1 and in Tables 3-14 through 3-18. Samples were analyzed for total petroleum hydrocarbons (TPH) (TPH-gasoline range, TPH-diesel range, and TPH-residual range), volatile organic compounds, semi-volatile organic compounds, pesticides and PCBs, and metals. Not all samples were analyzed for all target analytes. Because contaminants at Tin City LRRS are not limited to a particular class of chemical and many different compounds were detected during the 1995 RI (Montgomery Watson 1995a), a screening assessment was performed to identify COPCs. The screening procedure is described in Section 3.2.1.1, followed by a presentation of the COPC concentrations for the reasonable maximum exposure (RME) scenario in Section 3.2.2.2.

3.2.1.1 Risk-Based Screening Assessment

A screening of the contaminant data was performed to determine which chemicals might pose a potential human health risk. The screening consisted of the following four steps: (1) comparison of maximum detected concentration for each chemical in each medium with risk-based screening concentrations (RBCs), (2) comparison of maximum Practical Quantitation Limits (PQLs) to RBCs for chemicals which were not detected, (3) identification of organic chemicals which were detected but for which no RBCs are available, and (4) comparison of maximum concentrations of metals detected on-site to mean background concentrations for metals without RBCs. Each of these steps is described in greater detail below.

RBCs were obtained from U.S. EPA (1991c) Region 10 Supplemental Risk Assessment Guidance for Superfund and are given in Table 3-19. The RBCs correspond to a cancer risk of 10^{-6} (10^{-7} for soil) or a hazard quotient (for non-carcinogens) of 0.1. If both values were available for a particular chemical, the lower of the two values was used. Water RBCs were used for surface water data and soil RBCs were used for both soil and sediment data. The maximum concentration for each chemical in each medium was compared to the appropriate RBC. If the maximum concentration exceeded the RBC, the chemical was considered a COPC and was carried through the baseline human health risk assessment. For chemicals which were not detected at Tin City LRRS, an additional screening was performed to determine if the PQL exceeded the RBC. If the maximum PQL for a chemical in a particular medium exceeded the appropriate RBC, that chemical was added to the list of COPCs. Because the risk attributed to COPCs which were not detected above PQLs is less certain than risk attributed to detected COPCs, the two groups of chemicals were evaluated separately. If neither the maximum detected concentration or the maximum PQL exceeded the RBC, that chemical was not considered a COPC and was not evaluated further.

RBCs were not available for chemicals which did not have toxicity data (i.e., reference doses or slope factors). Organic chemicals in this category were also added to the list of COPCs if they

were detected at Tin City LRRS. An exception to this approach was made for the TPH fractions (diesel, gasoline, and residual) because toxicity data for the weathered fuels typical of TPHs are not available and the human health risk due to hydrocarbons could be assessed by characterizing the risk from the semi-volatile and volatile organic compounds which make up TPH. Metals for which RBCs were not available were added to the list of COPCs if they were detected at greater than three times (3X) the mean background concentration for a particular medium. Although these chemicals were considered to be COPCs, risk was not quantified due to the lack of toxicity data. The list of COPCs for each medium is given in Table 3-20. A total of 59 COPCs were identified using the approach described above. Within each of the three media, the number of COPCs ranged from 33 for sediment to 55 for surface water. The majority of the COPCs were never detected at Tin City LRRS above the PQLs (category 2 in Table 3-21). Blanks in Table 3-20 indicate that a chemical is not a COPC in that particular media.

3.2.1.2 COPC Concentrations for Reasonable Maximum Exposure (RME) Scenario

The RME scenario is a conservative approach whereby the exposure point concentration (EPC) that a particular individual could possibly be exposed to is defined as the 95 percent upper confidence limit (UCL) of the available sampling data for each investigative area/medium combination (U.S. EPA 1991c). In cases where the 95% UCL exceeds the maximum concentration, which is possible given a highly variable group of data points, the maximum concentration is used for the EPC. The EPCs for each of the COPCs given in Table 3-20 are given in Table 3-21. For COPCs which were not detected, one-half the PQL was used for the EPC, as suggested in U.S. EPA (1991c).

3.2.2 Exposure Assessment

An exposure assessment was conducted to estimate the type and magnitude of chemical exposures that humans may encounter at the Tin City LRRS site. The primary goals of the exposure assessment include:

- Site characterization
- Identification of potential human receptors and exposure pathways
- Determination of potential exposure scenarios, including the frequency and duration of exposure to COPCs
- Quantitative evaluation of the potential chemical exposures using measured and predicted estimates of chemical concentrations.

3.2.2.1 Exposure Routes

The exposure routes for the human health risk assessment (HRA) that were evaluated include: direct ingestion of contaminated soils, sediments or surface waters, inhalation of contaminated airborne dust, inhalation due to volatilization, and dermal contact with contaminated soils, sediments or surface waters. Consumption of terrestrial or aquatic organisms potentially affected by the contaminants will be qualitatively analyzed.

3.2.2.2 Receptors

The potential human receptors that were evaluated in the HRA include site personnel, recreational users, and subsistence users of Tin City LRRS. The LRRS personnel are the staff of Tin City LRRS and the Trading Post operator, who live and work at the Tin City LRRS throughout most of the year (e.g., the Trading Post operator) or all of the year (e.g., LRRS employees). Recreational and subsistence users include residents of Wales or other people who visit or use the site infrequently.

3.2.2.3 Exposure Pathways

A complete exposure pathway consists of a contaminant, a receptor contact, and a route for the uptake of the contaminant of concern. The following paragraphs present a qualitative screening of the potential exposure pathways at Tin City LRRS, including soil, air, surface water and sediment.

3.2.2.4 Soil Exposure Pathway

COPCs have been detected in surface soils at Tin City LRRS. Site personnel, as well as recreational and subsistence users of the Tin City LRRS site, which include picnickers, hunters and fishermen, have the potential to be exposed to chemicals detected in soils by incidental soil ingestion or dermal contact. Because surface soils are typically frozen for eight months of the year (U.S. Department of Commerce 1986), it is assumed that exposure to chemicals of concern in the soil would occur only during the 120 days of the summer months. Soil exposure is considered to be a potential exposure pathway and a quantitative risk evaluation was performed.

3.2.2.5 Air Exposure Pathway

Because site personnel and recreational and subsistence users of the Tin City LRRS site can be potentially exposed to chemicals of concern via inhalation, two air exposure pathways by which chemicals may reach the atmosphere were evaluated for Tin City LRRS: (1) airborne particulates (dust) from surface soils, and (2) volatilization from surface soils or waters. Because surface soils are typically frozen for eight months of the year, the potential for dust emissions or volatilization from soil was assumed to be limited to four months annually. Particulate emissions due to wind erosion from contaminated areas is dependent upon local wind speeds and the erodability of surface soils. For this contaminant pathway, soil contaminant data for the entire site (i.e., all terrestrial investigative areas) was pooled to derive the EPC; the highest concentration was used for the EPC. A quantitative risk evaluation was performed for the airborne particulate exposure pathway.

Volatilization of chemicals of concern is dependent upon their volatilization potential (Vp). Chemicals with a Vp less than 2.4E-7 atm·L·mole^{-1}, which includes pesticides, inorganic and some semi-volatile organics, do not generally volatilize into the environment (Wang and Jones 1994). For COPCs which had a Vp of greater than 2.4E-7 atm·L·mole^{-1}, no toxicological data for inhalation exposure were located; therefore, a quantitative risk evaluation was not performed for the volatilization exposure pathway.

3.2.2.6 Surface Water Exposure Pathway

Surface water runoff originating from the installation is topographically directed towards the Bering Sea via surface runoff and from Cape and the Unnamed creeks. Potential human exposure to surface waters at the Tin City LRRS exists. Possible exposure pathways include dermal contact with surface waters, incidental ingestion of surface waters, and inhalation of chemicals volatilized from water.

Dermal contact with surface waters would most likely occur along the beach front during recreational activities (e.g., setnetting, fish rinsing, or picnicking). This pathway is considered of potential significance for human exposure and a quantitative exposure and risk evaluation was performed. Quantitative exposure and risk evaluations were not performed for the other surface water exposure pathways. The incidental ingestion of surface waters is associated with swimming, but the cold temperature of the waters and ambient air in this area generally preclude this activity. Volatilization of chemicals of concern from surface waters is considered to be a pathway of low significance due to the relatively low number of chemical detections and their relatively low volatilization potential.

3.2.2.7 Sediment Exposure Pathway

Sediments represent another medium of possible exposure to site contaminants. Potential human exposure to lake sediments could occur during periods when the lake dries up and the sediment is exposed at the beach. Dermal exposure could occur from recreational or subsistence activities, or tracking of sediments on footwear. Ingestion of lake sediments is possible since children on the beach have unrestricted access to the lake area. Therefore, quantitative exposure and risk evaluations were performed for dermal exposure and ingestion of sediments in the lake.

3.2.2.8 Ingestion of Fish and Marine Mammals

Ingestion of aquatic animals that have come in contact with contaminants from Tin City LRRS may represent an indirect mode of chemical exposure. Exposures from the ingestion of marine mammals, such as the bearded seal, were qualitatively evaluated, as marine data from the Bering Sea were unavailable. Although equations exist that facilitate the calculation of chemical uptake of fish and marine animals, the paucity of data dictated that the assumptions for most all of the variables in the equation would each have a high degree of uncertainty, thereby rendering the risk estimate results meaningless.

Marine animals comprise the mainstay of the Village of Wales per capita subsistence harvest (Machida 1995). In particular, bowhead whales, bearded seals and walruses are the principal marine mammals hunted by the villagers. The exposure routes by which marine mammals may be affected by contaminants from Tin City LRRS includes contact with surface water, consumption of surface water and consumption of potentially impacted fish.

Neither the bowhead whales, bearded seals or walruses remain in one location, but forage over a wide area for food. Therefore, the frequency of exposure of these species to the Bering Sea waters

near Tin City LRRS is low. The opportunity, therefore, for ingestion of prey or contact with impacted media also is low.

3.2.2.9 Ingestion of Land Mammals

Ingestion of land mammals that have come in contact with Tin City LRRS may represent an indirect mode of chemical exposure. Caribou come no closer than 150 miles to the Village of Wales or Tin City LRRS and are infrequently hunted (Machida 1995). In contradiction of the information provided by the ADF&G, the residents of Wales indicated that caribou/reindeer migrate through the Tin City area and are part of their subsistence diet. However, caribou/reindeer are migratory animals that feed on browse throughout the area. With the exception of IRP Source Areas DP 011b and ST 12c, none of the potentially impacted areas support browse for caribou and reindeer. Caribou do not comprise a significant portion of the Tin City subsistence harvest. Therefore, the opportunity for ingestion of land mammals is low and no qualitative or quantitative analysis was performed.

3.2.3 Quantification of Exposure Assessment

Exposure is proportional to the chemical concentration detected in the contaminated medium and depends upon the rate of contact, the duration of exposure, and other site and receptor-specific characteristics. The intake factor (IF), which is calculated from these parameters, is multiplied by the detected concentration (EPC) in order to determine an exposure intake concentration. Specific values and assumptions that were used in estimating exposures are based on U.S. EPA (1989, 1990a. 1991a, 1992a) guidance and are presented in Table 3-22.

3.2.3.1 Inhalation Exposure

Exposure to fugitive dust via inhalation was calculated using the following formula:

$$Intake\ mg/kg/day) = \frac{C_a xIRxEXTxEFxED}{BWxAT} \qquad \text{(Equation 1)}$$

where:

C_a	=	Concentration in air (mg/m^3)	=	calculated from C_{soil}
IR	=	Inhalation rate (m^3/day)	=	20 (adults)/12 (children)
EXT	=	Exposure time (fraction of day)	=	0.5
EF	=	Exposure frequency (days/year)	=	120
ED	=	Exposure duration (years)	=	18 (adults)/6 (children)
BW	=	Body weight (kg)	=	70 (adults)/15 (children)
AT	=	Averaging time for pathway specific exposure period (ED x 365 days/year for noncarcinogens and 70 years x 365 days/year for carcinogens).		

The values used for IR, EXT, EF, ED, BW, and AT, together with the reference source for each value, are presented in Table 3-22. Both adult and child exposures were considered. The exposure frequency (EF) assumed that recreational and subsistence activities on the site occurred

primarily during the four-month period of the summer thaw. No exposure duration (ED) data specific to Tin City LRRS were available, so the exposure duration for adults was estimated using data provided in a 1992 survey of demographic characteristics of households in Kotzebue (Fall and Utermohle 1993, Tetra Tech 1995). The exposure duration for children and body weights of adults and children were based on U.S. EPA (1989) guidance.

The concentration of COPCs in air resulting from fugitive dust was estimated from soil concentration data. All soil samples from IRP source areas were pooled to estimate an EPC for contaminated areas; a separate EPC was estimated for the background from background soil samples. The EPC was then divided by a particulate emission factor (PEF).

$$C_{air} = \frac{C_{soil}}{PEF} \qquad \text{(Equation 2)}$$

Particulate emission factors were calculated using the following equation (Cowherd et al. 1985):

$$PEF(m^3/kg) = \frac{LSxVxDHxT}{A} \; x \; \frac{CF}{RFx(1-g)x(U_m/U_t)xF} \qquad \text{(Equation 3)}$$

where:

LS	=	Width of area (m)	=	chemical/specific
V	=	Wind speed in mixing zone (m/sec)	=	3.445
DH	=	Diffusion height (m)	=	0.4
T	=	Time in an hour (sec/hour)	=	3,600
A	=	Area of contamination (m^2)	=	chemical/specific
CF	=	Conversion factor (1000 g/kg)	=	1,000
RF	=	Respirable fraction ($g/m^2 \cdot hour$)	=	0.036
g	=	Fraction of vegetative cover	=	chemical/specific
U_m	=	Mean annual wind speed (m/sec)	=	6.89
U_t	=	Equivalent threshold value of wind speed at 10m (m/sec)	=	7
F	=	Function dependent on U_m/U_t (unitless)	=	1.53

The areas of contamination (A) of the various IRP source areas were estimated because not all areas were contaminated with the same compounds. Areas were calculated separately for metals, PCBs and pesticides, and SVOC/VOCs. These areas are presented in Table 3-23. The width was estimated as the square root of the total area (i.e., assuming that the total area was square). The background areas of contamination were estimated by assuming that the background sample location areas are similar to the area of contamination at observed points of contamination on the site. The area of these observed points are approximately $2m^2$. The areas presented in Table 3-23 were used for both detected and non-detected COPCs.

The mean annual wind speed (U_m) at Tin City LRRS was obtained from the Environment and Natural Resource Institute division of the Alaska State Climate Center. Wind speed in the mixing

zone (V) was estimated to be one-half the mean annual wind speed (U.S. EPA 1991b). The fraction of vegetative cover (g) was estimated to be based on similar terrain at Kotzebue LRRS (Tetra Tech 1995). The equivalent threshold value of wind speed was estimated using equations presented in Cowherd et al. (1985) for a particle diameter of 0.015 mm, which is characteristic of fine to medium sands. Values assumed for all other parameters are consistent with risk assessment guidance provided in U.S. EPA (1989).

3.2.3.2 Incidental Ingestion of Soil or Sediment

Ingestion of soil particulates occurs by the accidental ingestion of particles present on hands, edible plants grown in a contaminated area, or by swallowing particles collected in the nasal passages. The level of exposure depends on the chemical concentrations in soil, the amount ingested, and the frequency and duration of exposure. Exposures for adults and children were evaluated. U.S. EPA has determined that children may receive higher levels of exposure from soil contact due to their higher ingestion rate and may also be more sensitive to the effects of chemical exposures than adults.

Exposure via soil ingestion was calculated using the following equation:

$$Intake\ mg/kg/day = \frac{C_s x C_f x FIxIRxEFxED}{BWxAT} \qquad \text{(Equation 4)}$$

where:

C_s	=	Concentration in soil (mg/kg)	=	EPC
C_f	=	Conversion factor (kg/mg)	=	10^{-6}
FI	=	Fraction ingested from contaminated source	=	0.005
IR	=	Ingestion rate (mg/day)	=	100 (adults)/200 (children)
EF	=	Exposure frequency (days/year)	=	120
ED	=	Exposure duration (years)	=	18 (adults)/6 (children)
BW	=	Body weight (kg)	=	70 (adults)/15 (children)
AT	=	Averaging time for pathway specific exposure period (ED x 365 days/year for noncarcinogens and 70 years x 365 days/year for carcinogens).		

The values used for IR, EF, ED, BW, and AT, together with the reference source for each value, are presented in Table 3-22. It was conservatively assumed that 100 percent of ingested soil or sediment was from the Tin City LRRS site. However, not all of the soil and sediments within the Tin City LRRS site are contaminated. Therefore, the percentage of the total area which is contaminated was estimated. The contaminated area is 12,327 m^2, as shown in Table 3-23. The total area was calculated as 618 acres. This results in an estimate of 0.5% areal contamination (FI = 0.005).

3.2.3.3 Dermal Contact with Soil or Sediments

Chemical exposure can occur when dermal surfaces contact soils (or sediments) with subsequent absorption through the skin. Chemical exposure by dermal contact is a function of the chemical concentration in the soil, the skin area exposed, the amount of soil adhering to the skin, and the fraction of chemical absorbed through the skin.

Exposure via dermal soil and sediment contact was calculated using the following equation:

$$Intake\ (mg/kg/day) = \frac{C_s x CF x SS x AF x ABS x EF x ED}{BW x AT} \qquad \text{(Equation 5)}$$

where:

C_s	=	Concentration in soil (mg/kg)	=	EPC
CF	=	Conversion factor for chemical fraction of soil	=	10^{-6}
SS	=	Exposed skin surface area (cm^2)	=	2,020 (adults)/800 (children)
AF	=	Soil adherence factor ($mg/cm^2/day$)	=	1
ABS	=	Chemical absorption fraction	=	Chemical-specific
EF	=	Exposure frequency (days/year)	=	120
ED	=	Exposure duration (years)	=	18 (adults)/6 (children)
BW	=	Body weight (kg)	=	70 (adults)/5 (children)
AT	=	Averaging time for pathway specific exposure period (ED x 365 days/year for noncarcinogens and 70 years x 365 days/year for carcinogens).		

The values used for SS, AF, EF, ED, BW, and AT, together with the reference source for each value, are presented in Table 3-22. The exposed skin surface area (SS) for adults and children assumes that the only dermal contact with soil is from incidental exposure of the face and hands while working or during recreational and subsistence activities.

The chemical absorption fraction (ABS) depends upon the bioavailability of the chemical in the soil or sediment matrix, which is a factor of several soil and chemical characteristics, including the percentage of water in the soil and the water solubility of the chemical. Additionally, as the skin is an effective barrier to many compounds exposure is dependent upon the soil to skin partition coefficient which is a function of the lipophilicity and size of the chemical, and the thickness of the skin and exposed surface area. Chemical absorption fraction (ABS) values for chemical classes (California EPA 1994) were used to assign values for specific chemicals. ABS values assumed for chemical classes include: chlorinated insecticides (0.05), polycyclic aromatic hydrocarbons (0.15), PCBs (0.15), dioxins and furans (0.03), other organic compounds (0.10), cadmium (0.001), arsenic (0.03), and other inorganics (0.01).

3.2.3.4 Dermal Contact with Surface Water

Chemical exposure can occur via dermal contact with surface water. At Tin City LRRS, recreational and subsistence fishers, beachcombers, and picnickers have the potential to be exposed to contaminants at the beach. The level of potential chemical exposure by dermal contact is a function of the chemical concentration in the surface water, the area of skin exposed, the

permeability of the skin to the chemical, the exposure time, the body weight of the individual exposed, and the exposure frequency and duration. Additionally, a dermal permeability coefficient, which is a function of the chemicals' octanol-water partition coefficient and molecular weight, is a multiplier in this equation.

Exposure via dermal contact with surface water was calculated using the following equation:

$$Intake\ (mg/kg/day) = \frac{C_s x CF x SA x ET x EF x ED x P_c}{BW x AT} \qquad \text{(Equation 6)}$$

where:

C_s	=	Concentration in water (ug/L)	=	EPC
CF	=	Conversion factor (mg/ug x L/cm^3)	=	10^{-6}
SA	=	Exposed skin surface area (cm^2)	=	2,020 (adults)/800 (children)
ET	=	Exposure time (hours/day)	=	1.0
EF	=	Exposure frequency (days/year)	=	120
ED	=	Exposure duration (years)	=	18 (adults)/6 (children)
P_c	=	Dermal permeability constant (cm/hour)	=	Chemical-specific
BW	=	Body weight (kg)	=	70 (adults)/15 (children)
AT	=	Averaging time for pathway specific exposure period (ED x 365 days/year for noncarcinogens and 70 years x 365 days/year for carcinogens)		

The values used for ET, EF, ED, PC_c, BW, and AT, together with the reference source for each value, are presented in Table 3-22. Both adult and child exposure was considered. The exposed skin surface area for adults and children assumes that the only dermal contact with water is from incidental exposure of the face and hands during recreational and subsistence activities.

3.2.4 Toxicity Assessment

Toxicity information for the COPCs was obtained from U.S. EPA toxicity databases, including the 1994 fourth quarter edition of Integrated Risk Information System (IRIS) (U.S. EPA 1994b) and the 1994 Annual Health Effects Assessment Summary Tables (HEAST) (U.S. EPA 1994a).

3.2.4.1 Toxicity Values for Non-carcinogenic Chemicals

Non-carcinogenic toxicity values for COPCs are shown in Table 3-24. This table provides the critical effect, reference dose (RfD) for both oral and inhalation exposure routes (if available), and the source for these RfDs. The confidence level, uncertainty factor (UF), and modifying factor (MF) assigned to each toxicity value by the U.S. EPA is also provided. The confidence level is a measure of the uncertainty associated with the experiments upon which the RfD is based. Uncertainty factors reflect the uncertainties associated within the data extrapolations for estimating the RfD (e.g., subchronic versus chronic study; rodent or primate versus human study). The modifying factor, which ranges from 1-10, is also based on an evaluation of the uncertainties of the data used to create an RfD. U.S. EPA uses a default modifying factor of one.

3.2.4.2 Toxicity Values for Carcinogenic Chemicals

Carcinogenic toxicity values for COPCs are shown in Table 3-25. This table provides the cancer slope factor (SF) for both oral and inhalation exposure pathways (if available). There are currently no SFs available for dermal exposure. The uncertainty associated with the carcinogenic potential of these chemicals is expressed by U.S. EPA's weight of evidence classification. Each chemical falls into one of five classes depending upon the evaluation of human and animal studies. The classifications include:

Group	Category
A	Human Carcinogen
B	Probable human carcinogen
	B1 - Limited human evidence
	B2 - Sufficient evidence in animals, no human evidence
C	Possible human carcinogen
D	Not classifiable as a human carcinogen
E	Evidence of non-carcinogenicity in humans

3.2.4.3 Toxicity Values for Dermal Exposure

There are currently no U.S. EPA reference doses or slope factors for dermal exposure. According to U.S. EPA guidelines, oral RfDs and SFs can be adjusted by using chemical-specific oral absorption efficiency factors to characterize the risk from dermal exposure (U.S. EPA 1989). This adjustment accounts for the difference between an orally administered dose and a dermally absorbed dose. Oral absorption efficiencies were obtained from chemical specific Agency Toxic Substances & Disease Registry (ATSDR) toxicological profiles. The calculations were as follows:

Adjustment for RfD:	RfD x oral absorption efficiency (%)	=	Dermally adjusted RfD
Adjustment for SF:	SF/oral absorption efficiency (%)	=	Dermally adjusted SF

Chemicals which readily volatilize, including all volatile organic and semi-volatile organic compounds with a vapor pressure greater than 2.4E-7 atm·L·mole^{-1}, were assumed not to pose a substantial risk upon dermal exposure (Wang and Jones 1994). Oral absorption efficiencies for detected semi-volatile organic compounds with a vapor pressure less than 2.4E-7 atm·L·mole^{-1}, pesticides, and PCBs are shown in Table 3-26, along with the appropriate ATSDR toxicological profile source.

3.2.4.4 Toxicity Profiles

A short toxicological profile for each detected COPC at the Tin City LRRS is included in Table 3-23. General toxicity information and a summary of the information used in the development of the slope factor or reference dose is provided for each COPC. Sources for the toxicological information are (in order of hierarchy): IRIS (U.S. EPA 1994b); HEAST (U.S. EPA 1994a); and ATSDR toxicological profiles (chemical-specific).

3.2.5 Risk Characterization

Comparison of the calculated exposure values to benchmark criteria such as reference doses, reference concentrations, hazard indices, no observable adverse effects levels and lowest observable effects levels is included in the Human Health Baseline Risk Assessment.

Carcinogenic risk probabilities were calculated by multiplying the exposure intake (EI) by the route-specific cancer slope factor (SF):

$$R_c = EI \ x \ SF_c \qquad \text{(Equation 7)}$$

where:

R_c	=	Estimated individual excess lifetime cancer risk for chemical c
SF_c	=	Route and chemical-specific cancer shape factor for chemical c (kg.day/mg)
EI	=	Exposure intake [mg/(kg.day)]

An excess individual lifetime cancer risk of 1.0E-6 (10^{-6}) is generally used by the U.S. EPA as a benchmark when determining whether chemical exposures represent a potentially unacceptable level of risk to public health. According to the revised National Contingency Plan (NCP) (U.S. EPA 1990b), carcinogenic risks from exposure at Superfund sites are considered to be unacceptable at a level greater than 1.0E-4 (10^{-4}), while risks smaller than 1.0E-6 are considered to be of minimal concern. For the purposes of this risk assessment, an excess individual lifetime cancer risk of 1.0E-6 will be used to assess the potential for adverse impact to public health from the contamination at Tin City LRRS.

Non-carcinogens are considered to exhibit threshold effects (i.e., a critical chemical dose must be exceeded before a health effect is observed). The potential for adverse health effects is assessed by the ratio of the exposure intake (EI) and the route-specific reference dose (RfD):

$$HQ_c = EI/RfD_c \qquad \text{(Equation 8)}$$

where:

HQ_c	=	Hazard quotient for chemical c
RfD_c	=	Route-specific reference dose for chemical c (kg·day/mg)
EI	=	Exposure intake [mg/(kg·day)]

The hazard quotient (HQ) is accepted by the U.S. EPA as a way to quantify levels of risk for non-carcinogens (U.S. EPA 1989). A HQ value greater than one indicates that adverse health effects may occur due to chemical exposure.

Tin City LRRS was divided into four areas based on considerations of surface water drainage patterns, historical spill locations, consideration of human exposure pathways, and potential remediation efforts. The resulting four areas are listed below:

- Lower Camp, Tramway, Upper Camp
- Beach Site (except DP 011b)
- Airstrip
- DP 011b

Risks estimates were characterized at each of these four areas by calculating EPCs for all COPCs (see Section 3.2.1) and using the equations and assumed parameters discussed in Section 3.2.2. Separate risk estimates for all four areas listed above were calculated for ingestion and dermal exposure pathways. Risk estimates for inhalation of dust exposure pathways were evaluated by considering all data collected at the Tin City LRRS IRP and AOC locations; background inhalation of dust exposure pathways was separately evaluated. The risk estimate for the ingestion of marine or terrestrial organisms was evaluated qualitatively. Tables 3-27 through 3-36 present the quantitative HQ and/or carcinogenic risk estimates for each COPC for each area.

3.2.5.1 Inhalation of Airborne Dust.

The risk estimates from detected COPCs for inhalation of carcinogenic chemicals in dust in the IRP areas are zero (0) for both adults and children (Table 3-37). The background risk estimates from detected COPCs for inhalation of carcinogenic chemicals in dust were 2.03E-9 and 1.89E-9 for adults and children, respectively, due entirely to arsenic measured in the background sample SS K2. Non-carcinogenic risk from detected COPCs from this pathway was zero for both adults and children for both the IRP areas and background. Therefore, these data and calculations show that inhalation of airborne dust from IRP sources and AOC does not pose a risk to human health above EPA benchmarks.

3.2.5.2 Ingestion of Soil/Sediment.

The risk estimates to adults for ingestion of carcinogenic chemicals in soil at Tin City LRRS ranged from zero (0) at the Beach, DP 011b, and Airstrip areas to 2.46E-8 at the Lower Camp, Tramway, and Top Camp (Table 3-38). The carcinogenic risk estimates to children from this pathway ranged from zero (0) at the Beach, DP 011b, and Airstrip areas to 7.65E-8 at the Lower Camp, Tramway and Top Camp (Table 3-38). The HQ estimates for ingestion of non-carcinogenic chemicals in soil were zero (0) for both adults and children (Table 3-38).

The risk estimates to adults for ingestion of carcinogenic chemicals in sediment at Tin City LRRS ranged from zero (0) at the Airstrip to 7.93E-9 at the Beach area. The carcinogenic risk estimates to children from this pathway ranged from zero (0) at the Airstrip to 2.47E-8 at the Beach area (Table 3-38). The HQ estimates for ingestion of non-carcinogenic chemicals in sediment were zero (0) for all areas for both adults and children (Table 3-38).

These data show that ingestion of soil and sediment from IRP sources and AOC does not pose a risk to human health above EPA benchmarks.

3.2.5.3 Dermal Contact With Soil/Sediments

The risk estimates to adults for dermal contact with carcinogenic chemicals detected in soil at Tin City LRRS ranged from zero (0) at the Beach, DP 011b, and Airstrip areas to 1.66E-5 at the Lower Camp, Tramway, and Top Camp (Table 3-39). The carcinogenic risk estimates to children from this pathway ranged from zero (0) at the Beach, DP 011b, and Airstrip areas to 1.02E-5 at the Lower Camp, Tramway, and Top Camp (Table 3-39).

The highest HQ estimates for dermal contact with non-carcinogenic chemicals in soil were 0.19 and 0.36 for adults and children, respectively, which are below the EPA benchmarks, in the Lower Camp, Tramway and Top Camp (Table 3-39).

The risk estimates to adults and children for dermal contact with carcinogenic chemicals detected in sediment were zero (0) for all locations. (Table 3-39). The hazard quotient estimates for ingestion of non-carcinogenic chemicals in sediment were zero (0) for both adults and children (Table 3-39). The exceedance of the 1.0E-6 cancer risk threshold at the Lower Camp, Tramway and Top Camp (soil) was due to Aroclor 1242, 1254, and 1260 (Table 3-40) in isolated soil samples at AOC 2 and AOC 3.

Risk levels attributed to non-detected COPC ranged from 7.72E-7 to 6.89E-6 at the Beach Area; Lower Camp, Tramway and Top Camp; Airstrip; and background. Risk levels attributed to non-detected COPC at DP 011b were 1.76E-4 and 1.08E-4 for adults and children, respectively.

These data show that, based on the conservative assumptions in the Risk Assessment, isolated areas of PCBs in soil fall just within the EPA benchmarks of 1.0E-6 to 1.0E-4.

Non-detected COPC at the site resulted in risk estimates falling above the EPA threshold of 1.0E-6 but within the EPA benchmarks of 1.0E-6 to 1.0E-4 for the Beach Area; Lower Camp, Tramway and Top Camp; Airstrip; and background. Risk estimates fell above the EPA benchmarks for DP 011b due to the elevated laboratory detection limits. Although there are no data showing these compounds were present, conclusive estimates cannot be made.

3.2.5.4 Dermal Contact with Surface Water

The risk estimates for dermal contact with carcinogenic chemicals detected in the surface water was zero (0) for all areas (Table 3-41). The HQ estimates for non-carcinogenic chemicals was zero (0) for all areas (Table 3-41).

Elevated laboratory detection limits for several non-detected COPC, namely, benzo-(a)-anthrecene, benzo-(a)-pyrene, and benzo-(a)-fluoranthrecene, resulted in risk estimates above the EPA benchmarks of 1.0E-6 to 1.0E-4 at the Beach, Airstrip, and background. Although there are no data showing that these compounds are present, conclusive estimates cannot be made.

3.2.5.5 Ingestion of Fish and Marine Mammals

The qualitative risk estimate for the ingestion of Chum salmon and bearded seal by subsistence hunters (both adults and children) indicates the risk associated with this exposure pathway is very low. The frequency of exposure of these animals to Tin City LRRS contaminants is so low, that the likelihood of the contaminants existing within the edible portions of these animals is consequently very low.

3.2.6 Summary of Risk Estimates

Of the exposure pathways evaluated at Tin City LRRS, only one shows the potential for some risk to humans as indicated by total carcinogenic risk estimates of greater than 1.0E-6 based on detected COPC. The pathway is dermal contact with soil containing low levels of PCBs at AOC 2 and AOC 3. No significant risk was predicted for the consumption of potentially contaminated species harvested at the Tin City LRRS.

Table 3-42 shows the sum of the risk estimates calculated for all exposure pathways evaluated at each of the four investigative areas and background areas. The risk estimates for each investigative area include the risk estimate from the pathways that were evaluated using an EPC from the entire site (e.g., inhalation). For detected carcinogenic COPCs, the total risk to adults ranged from zero (0) at the Airstrip and DP 011b areas to 1.66E-5 at the Lower Camp, Tramway, and Top Camp, and from zero (0) at the Airstrip and DP 011b areas to 1.03E-5 at the Lower Camp, Tramway, and Top Camp for children. For detected non-carcinogenic COPCs, the total risk at the Beach area, Airstrip and DP 011b was zero (0) for adults and children, while the highest total HQ risk was at the Lower Camp, Tramway, and Top Camp (0.19 and 0.36 for adults and children, respectively) (Table 3-42).

A total of three chemicals (Aroclor 1242, Aroclor 1254 and Aroclor 1260) were detected at concentrations that resulted in risk estimates exceeding a cancer risk of 1.0E-6 for a particular exposure pathway. The locations of the individual samples that exceeded risk-based screening levels for these COPCs are AOC 2 and AOC 3 and are shown in Table 3-43.

Throughout this baseline human health risk assessment for Tin City LRRS, U.S. EPA standard default exposure values were used for the majority of exposure parameters unless site-specific information was available. The default exposure values are intended to reflect upper bound estimates for various activities to avoid underestimation of chemical exposure and consequent health risks. Where there was a lack of default values and site-specific information, estimates based upon conservative assumptions were derived. It is likely that the use of conservative assumptions resulted in an overestimate of exposure and the potential for human risk. By using this approach, one exposure pathway demonstrated a potential for human health risk: dermal contact with soil. A discussion of the conservative assumptions used in the quantification of risk is presented in Section 3.2.7.

3.2.6.1 Background Risk Estimate

Risk estimates for background data were developed in order to compare background risk levels to risks attributable to activities at Tin City LRRS. The combined risk levels from COPCs detected in background samples were approximately 6% of the risk levels estimated for the Lower Camp, Tramway, and Top Camp; risk levels from COPCs detected in background samples were much higher than risk estimations for the DP 011b, Beach and Airstrip areas. The background COPCs consisted only of arsenic and Aroclor 1254; the arsenic measured in the background sample SS K2 entirely accounts for the background risk level estimated from inhalation of dust (Table 3-37). Figure 3-8 graphically compares adult carcinogenic risks estimates for each area to the adult carcinogenic background risk estimate. It can be argued that the contamination at background locations is likely not attributable to activities at Tin City LRRS.

3.2.7 Uncertainty

3.2.7.1 Representative Exposure Concentrations

Exposure point concentrations in the three media sampled were based on the 95% UCL of the mean (except in cases where the 95% UCL exceeded the maximum, in which case the maximum concentration was used), with half of the PQL used for samples in which the chemical was not detected. The use of the UCL and PQL takes into account the number of samples and the variability in the detected values. Therefore, the exposure estimates are based on reasonable maximum exposure concentrations.

Following U.S. EPA (1989) guidance, estimated data values (i.e., J and UJ qualified data) were used in the risk evaluations. This may lead to an overestimation of risk, as these data may not be reflective of the actual concentration(s) of the chemical(s) in media analyzed.

Areal extent of contamination was based on extrapolations of data and limited sampling. the potential for error is introduced by these estimate; however, the estimates were calculated to be conservative. For example, risk estimates for detected COPC were based on the detection of PCBs in only three samples: two at AOC 2 and one at AOC 3.

3.2.7.2 Exposure Assumptions

It was assumed that recreational and subsistence users who frequent the site are exposed to contaminants every day during the four summer months every year. This may overestimate the risk due to the fact that there are no residences on site, and recreational users may only frequent the site for a period of several weeks during the summer months and may not return year after year.

Relatively few studies have been performed on the evaluation of chemical absorption by the skin, particularly chemicals that occur in a soil matrix. Volatilization, friction and washing may remove some fraction of the chemical before it can be absorbed through the skin. By assuming a constant absorption fraction for chemicals associated with soils and sediments, the amount of chemical absorbed by an individual may have been overestimated.

3.2.7.3 Toxicity Evaluations

Toxicity criteria for most of the COPCs are based on animal studies. The U.S. EPA specifically acknowledges this uncertainty in the reference dose data by including uncertainty or modifying factors to adjust animal data to values potentially representative of human levels of concern (see Tables 3-23 and 3-24). Toxicity criteria may overestimate or possibly underestimate the magnitude of potential adverse health effects associated with a given level of chemical exposure.

3.3 BASELINE ECOLOGICAL RISK ASSESSMENT

This section presents the ecological risk assessment as described in Section 2.4.3, and includes subsections describing background data, selection of chemicals of potential ecological concern, exposure assessment, risk characterization, and uncertainty analysis.

3.3.1 Background Data

Surveys and interviews were conducted in order to obtain specific information on what species are present at Tin City LRRS, information pertinent to those species, and for demographic information on the village of Wales.

3.3.1.1 1994 and 1995 Alaska Biological Research, Inc. Field Observations

Alaska Biological Research, Inc. (ABR) has been retained by the USAF to conduct surveys at remote Air Force Stations. ABR has conducted two surveys at Tin City LRRS. The following information was obtained from a telephone interview conducted by Susan Mearns (Montgomery Watson) with Bob Day (ABR) on Monday, 16 October 1995, and from a facsimile transmittal of excerpts from *Spectacled and Steller's Eider Surveys at Remote Air Force Sites in Alaska, 1994 Annual Report* and *Kittlitz's Murrelet Surveys at Remote Air Force Sites in Alaska, 1995 Draft Final Report.*

ABR identifies Tin City LRRS as located in the Seward Peninsula Physiographic Province, which consists of extensive uplands, isolated rugged, glaciated mountains and coastal lowlands (ABR 1994). The tree line of the peninsula extends to the eastern half, however the western half contains patches of willow (*Salix* spp.) and alder (*Alnus* spp.) shrubs in low-lying river valleys and tundra in other areas (ABR 1994). Tin City LRRS is described as "...consisting of upland dwarf-shrub tundra that generally is rocky and barren. At the base of the bluffs south of the Lower Camp and west of the runway are unconsolidated sediments that are vegetated with grasses and sedges, are wet in places, and contain small shallow open lakes without islands. Disturbed habitat occurs around all facilities, and along Cape Creek and its outwash plain, as devegetated ground, remains of old buildings, concrete bunkers, empty 55-gallon barrels, and other debris." (ABR 1994, pg. 6).

Species of Special Concern (category 2 species) are species that are no longer on the Endangered Species Act (ESA) list as threatened species, per the USFWS revision of ESA lists of threatened and endangered species. Species of Special Concern observed by ABR personnel at Tin City LRRS include: Harlequin Duck and Kittlitz's Murrelet (ABR 1995, Appendix 2). The Kittlitz's

Murrelet was observed nesting during the summer of 1995, the Harlequin Duck was observed off the coast during the summer of 1995 (personal communication, S. Mearns with B. Day). Additionally, ABR identified two (2) suitable habitats for nesting and brood-rearing of Spectacled and Steller's Eiders (Steller's Eiders are a Species of Special Concern) at Tin City LRRS (ABR 1994). The habitats were identified as "shallow open water" and "nonpatterned wet meadow" (ABR 1994).

Additional species observed by ABR personnel include: Pacific Loon, Pelagic Cormorant, Semipalmated Plover, Western Sandpiper, Baird's Sandpiper, Rock Sandpiper, Pomarine Jaeger, Parasitic Jaeger, Long-Tailed Jaeger, Slaty-backed Gull, Glaucous Gull, Black-Legged Kittiwake, Common Murre, Horned Puffin, Snowy Owl, Horned Lark, Common Raven, Northern Wheatear, Varied Thrush, White Wagtail, American Pipit, Savannah Sparrow, Lapland Longspur, Snow Bunting, Alaska hare, musk ox, barren-ground caribou, red fox, harbor/largha seal, Arctic ground squirrel, and voles and/or lemmings (ABR 1995, Appendix 2).

3.3.1.2 USFWS Field Observations

The following information was obtained from a telephone interview conducted by Susan Mearns (Montgomery Watson 1995) with Charlie Lean (USFWS) on Monday, 16 October 1995. Mr. Lean described Tin City LRRS as a "moonscape due to the climate and highly mineralized soils" (personal communication S. Mearns with C. Lean). The creek that flows to the south was described by Mr. Lean as "never supporting any fish populations", and "most streams along the that stretch of coast do not contain fish" asserted Mr. Lean (personal communication S. Mearns with C. Lean). Furthermore, Mr. Lean stated that there is "no commercial fishing and no sport fishing due to the currents, ice floes and lack of resources (fish) off the coast" (personal communication S. Mearns with C. Lean). The subsistence fishing Mr. Lean was aware of by the villagers of Wales was "generally to the north of Tin City LRRS, along the lagoons of Chukchi Sea" (personal communication S. Mearns with C. Lean). Mr. Bret Berglund, however, observed set nets being used by local residents to catch salmon directly off the beach at Tin City LRRS (personal communication S. Mearns with B. Berglund of Booz-Allen & Hamilton, Inc.).

Species Mr. Lean identified as inhabiting the offshore waters in the vicinity of Tin City LRRS include: Dolly Varden, blue king crab (near shore), various snails and whelks, walrus (whelk eater), bearded seal (whelk eater), spotted seal (fish eater), saffron cod (estuarine), Arctic cod (estuarine), Pacific herring (migratory), chum salmon (migratory). Mr. Lean also pointed out that evaluating potential effects of chemicals attributable to Tin City LRRS to species inhabiting offshore waters was going to be difficult, as a tin mine and platinum mine are located in close proximity to Tin City LRRS and the coast.

3.3.1.3 Other Telephone Interviews

Telephone interviews were made in an effort to obtain specific information on representative species identified in the Tin City LRRS vicinity and for demographic information on the village of Wales. On 22 November, 1995 a telephone interview was conducted by Ignacio Murillo (Montgomery Watson) with Steve Machida, a Unit 22 Area Management Biologist for the Alaska Department of Fish and Game, from which pertinent information on terrestrial mammals was

obtained. Mr. Machida was able to provide specifics on body weight, feeding habits, breeding habits, and range and migration data for the Arctic fox and the Arctic ground squirrel. Mr. Machida was unable to provide specific data on birds that are under federal jurisdiction due to their range in migration habits across state boundaries.

A telephone interview was also conducted by Ignacio Murillo with Mike Brooks, community health aid for the village of Wales, on November 28, 1995. Mr. Brooks provided specifics on demographics and frequency of hunting activities associated with the villagers of Wales. Mr. Brooks has been living in the village of Wales for approximately 8 years, thus his input serves as an invaluable resource for obtaining specifics on living conditions in the village of Wales. The following information was obtained during the telephone conversation:

The village of Wales is located about 15 miles east of Tin City LRRS. Approximately 170 people live in the maritime village of Wales, of which approximately 60 are under the age of 18 years old. Marine mammals comprise the mainstay of the villager diet. In particular, whales (i.e., bowhead whale), seals (i.e., bearded seal), and walruses are the principal marine mammals hunted/fished by the villagers. Birds (i.e., seabirds and eiders) form a less significant portion of the villager diet. Berries, willow greens, and dry goods also make up a part of the principal nourishment. The frequency of hunting/fishing activities is minimal and dependent on the season. There is an existing road that traverses along the side of a mountain range leading into Tin City LRRS which is passable only during the spring, summer, and fall. When the road is traversable, villagers of Wales go to Tin City for purchase of dry goods, groceries, and other general supplies available from a general convenience store. Water supply to the village is furnished by an existing creek along the hillside, which freezes in the winter; when it melts, it develops a natural spring of potable water supply to the village of Wales.

3.3.1.4 Selection of Key Ecological Receptors

Based on the available ecological information concerning species present in the Tin City LRRS area, the following five key receptor species were selected for this baseline ecological risk assessment: the Arctic fox, Arctic ground squirrel, Steller's Eider, Semipalmated Plover, and the Kittlitz's Murrelet. The criteria for selecting the receptor species to be evaluated included its' abundance in the Tin City LRRS vicinity and the availability of reference toxicity data for the same or similar species. Each of the five receptors has been observed at Tin City LRRS. All the receptors are terrestrial as sampling has indicated that most significant contamination is located in the gravel pads or tundra with little migration toward the Bering Sea. The baseline ecological risk assessment focused on predicting effects to individual species, therefore, a food web analysis, which would be appropriate for evaluation of community effects, was not performed. Specific data pertaining to each of the five receptors are discussed in the following paragraphs. Cape Mountain lies between Tin City LRRS and Wales, so the Wales water supply is topographically removed from the Tin City LRRS. No pathway for contamination of the Wales water supply by Tin City LRRS is evident.

Arctic fox: The Arctic fox *(Alopex lagopus)* lives on tundra above the northern boundaries of tree growth, primarily near shores. An adult fox commonly weighs about 10 pounds and feeds on birds, carrion, ground squirrels, mice, and lemmings. In winter the fox follows polar bears and

gets a share of the meat feasted on by the polar bears. The Arctic fox lives in dens in bluffs along the coast line; the depth of dens are approximately 2-3 feet. The Arctic fox mates early in the year with the males fighting fiercely for possession of the females. Six to twelve cubs are born in May or June after a gestation period of 51 to 57 days. Every 3 or 4 years, roving bands of young Arctic foxes gather for a mass migration in search of unoccupied land. The Arctic fox does not hibernate nor does it migrate south to the shelter of timber as winter approaches. (Encyclopedia Americana 1995, Collier's 1995, Machida 1995).

Arctic ground squirrel: The Arctic ground squirrel *(Citellus parryi)* lives in the Far North throughout Alaska and the Northwest Territories. Weights range from 1/4 pound to 1 3/4 pounds. The Arctic ground squirrel feeds on the green parts of plants, but some also eat fruits and seeds. The squirrel is diurnal, lives in the ground in small, family size colonies and hibernates for about seven months during winter when food is scarce. The burrows average 1-1 1/2 feet in depth up to a maximum of 2 feet on dry ground. The home range is approximately 100 square feet from sight of burrow. One to fifteen young may be born in a litter after a gestation period of 23 to 30 days. (Encyclopedia Americana 1995, Collier's 1995, Machida 1995).

Steller's Eider: The Steller's Eider *(Polysticta stelleri)* range is the Arctic coasts of Siberia and Alaska, and the Bering Sea. During winters the Steller's Eider migrates to the Aleutian Islands southwest to the Kodiak Island area. Weights range from 30 to 32 ounces for the female and 30 to 34 ounces for the male. Flocks feed near sunken ledges and rocky islets and also in shallow, sandy, muddy bays. Animal food comprises 87% of the diet and includes amphipods, isopods, barnacles, crabs, mollusks (e.g., blue mussels, razor clams, moon shells, periwinkles, etc.), aquatic insects, small fish, annelid worms, and sand dollars. Plant food comprises the remaining 13% of the diet: pond weeds, seeds, vegetal parts, eelgrass, crowberries, and algae. The Steller's Eider nests in deep holes in mosses of tundra lined with down, generally on or near edge of a pond or on tidewater flats. The male remains with the female until she has laid her eggs (around June-July) and starts incubating, then moves south. (Encyclopedia Americana 1995, Collier's 1995, Audubon 1977).

Kittlitz's Murrelet: The Kittlitz's Murrelet *(Brachyramphus brevirostris)* range during the summer is from Point Barrow, Alaska, south to Glacier Bay and during winters is on adjacent open seas and from southeastern Siberia to northern Japan. The average weight is 8 1/3 ounces. The Kittlitz's Murrelet feeds on crustaceans. Nest sites are on bare rock some distance from the sea, above timberline in mountains. Eggs are laid during May-June. (Encyclopedia Americana 1995, Collier's 1995).

Semipalmated Plover: The Semipalmated Plover *(Charadrius semipalmatus)* is found in the Far North from Alaska to Nova Scotia. Weight ranges from 1 to 2-1/2 ounces in fall and 1-1/2 to 2-1/3 ounces in summer. Along the seacoast, the Semipalmated Plover eats marine worms, small mollusks, small crustaceans, and the eggs of marine animals and insects, including larvae of the salt-marsh mosquito. Inland, the Semipalmated Plover eats large amounts of grasshoppers and earthworms. Nests are in depressions found in sand or gravel on the beach which the Semipalmated Plover scoops out; or in moss or lichens above the high-water mark, sometimes lined with bits of shells or grasses. Eggs are laid during June. (Encyclopedia Americana 1995, Collier's 1995).

3.3.2 Contaminants of Potential Ecological Concern

The results of sampling analyses conducted during the 1995 RI are reported in detail in Section 3.1 and in Tables 3-14, 3-15, 3-16, 3-17, and 3-18. Samples were analyzed for total petroleum hydrocarbons (TPH-gasoline range, TPH-diesel range, and TPH-residual range), volatile organic compounds, semi-volatile organic compounds, pesticides and PCBs, and metals. Not all samples were analyzed for all target analyses. Because contaminants at Tin City LRRS are not limited to a particular class of chemical and many different compounds were detected during the 1995 RI (MW 1995a), a screening assessment was performed to identify Chemicals of Potential Ecological Concern (COPEC). The screening procedure is described in Section 3.3.2.1, followed by a presentation of the COPEC concentrations for the reasonable maximum exposure (RME) scenario in Section 3.3.2.2.

3.3.2.1 Screening Assessment

A screening of the contaminant data was performed to determine which chemicals might pose a potential risk to ecological receptors. The screening was very similar to that performed for the human health baseline risk assessment (see Section 3.2.1). The screening consisted of the following four steps: (1) compare maximum detected concentration for each chemical in each medium with screening concentrations (RBCs), (2) compare maximum PQLs to RBCs for chemicals which were not detected, (3) identify organic chemicals which were detected but for which no RBCs are available, and (4) compare maximum concentrations to mean background concentrations for metals without RBCs. Each of these steps is described in greater detail below.

Screening concentrations consisted of both surface water criteria and sediment quality guidelines, both of which are intended to be protective of aquatic organisms which are present in these media. Surface water quality criteria (the lower of the acute or chronic fresh water values) promulgated by U.S. EPA (1991d) were used to evaluate surface water contaminant concentrations at Tin City LRRS. Sediment quality guidelines were obtained from several sources, including *Adverse Effects to Benthic Organisms in Sediment* (Long and Morgan 1990), *Ontario Aquatic Sediment Quality Guidelines* (Persaud et al. 1993), and *Sediment Criteria for New York State* (Newell and Sinnott 1993). U.S. EPA sediment quality criteria were not used because lower (more conservative) values have been published in the above sources. For a given chemical, the lowest concentration from the above three sources was used as the RBC for both sediment and soil concentrations at Tin City LRRS. Sediment guidelines were used for soil concentrations because soil quality guidelines are not available. The RBCs for soil and sediment were adjusted from the original values by using the mean total organic compound value (TOC). No TOC data for Tin City LRRS were available, so the TOC value measured at Kotzebue LRRS was used. The screening concentrations used at Tin City LRRS are given in Table 3-44. The maximum concentration for each chemical in each medium was compared to the appropriate screening concentration if the maximum concentration exceeded the screening concentration, the chemical was considered a COPEC and was carried through the baseline ecological risk assessment. For chemicals which were not detected at Tin City LRRS, an additional screening was performed to determine if the PQL exceeded the RBC. If the maximum PQL for a chemical in a particular medium exceeded the appropriate RBC, that chemical was added to the list of COPECs. Because the risk attributed to

COPECs which were not detected is less certain than risk attributed to detected COPECs, the two groups of chemicals were evaluated separately. If neither the maximum detected concentration or the maximum PQL exceeded the RBC, that chemical was not considered a COPEC and was not evaluated further.

Organic chemicals for which no RBCs were available were also added to the list of COPECs if they were detected at Tin City LRRS. An exception to this approach was made for the TPH fractions (diesel, gasoline, and residual) because toxicity data for the weathered fuels typical of TPHs are not available and the ecological risk due to hydrocarbons could be assessed by characterizing the risk from the semi-volatile and volatile organic compounds which make up TPH. Metals for which no RBCs were available were also added to the list of COPECs if they were detected at greater than three times the mean background concentration for a particular medium. The list of COPECs for each medium is given in Table 3-45. A total of 66 COPECs were identified using the approach described above.

3.3.2.2 COPEC Concentrations for Reasonable Maximum Exposure Scenario

The RME scenario is a conservative approach whereby the exposure point concentration (EPC) that a particular animal is likely to be exposed to is defined as the 95 percent upper confidence limit (UCL) of the available sampling data for each investigative area medium combination (U.S. EPA 1991c). In cases where the 95% UCL exceeds the maximum concentration, which is possible given a highly variable group of data points, the maximum concentration is used for the EPC. At many sites in Tin City LRRS, the size of the data pool (i.e., number of locations analyzed) was not sufficiently large for reliable calculation of the 95% UCL. Conservatively, the maximum compound concentrations measured at any one site were used in the risk estimate calculations for that site. The EPCs for each of the COPECs shown in Table 3-45 are given in Table 3-46. For COPECs which were not detected, one-half the PQL was used for the EPC, as suggested in U.S. EPA (1991c).

3.3.3 Toxicity Assessment

This section describes the assessment and measurement endpoints to be used in the ecological risk assessment and the concentrations of COPECs that could be expected to result due to the choice of endpoints.

3.3.3.1 Assessment and Measurement Endpoints

An endpoint is a characteristic of an ecological component (e.g., survival of an important species) that may be affected by exposure to a stressor (U.S. EPA 1992b). Two types of endpoints, assessment endpoints and measurement endpoints, are commonly used in ecological risk assessments. Assessment endpoints are expressions of the actual environmental value that is to be protected (e.g., continued health of an important population of animals). Measurement endpoints are measurable responses to a stressor that, ideally, are related to the chosen endpoint (U.S. EPA 1992b). Measurement endpoints at the individual level (e.g., mortality, reproduction, and growth) can be used to predict effects on an assessment endpoint at the population level. The measurement endpoints may or may not be the same for each chemical. Ideally, the chosen measurement end-

point is specific to the chosen key receptor species; however, lack of species-specific toxicity data for many wildlife species often makes extrapolation necessary.

For the five key receptor species selected, the assessment endpoints are the continued existence of healthy, viable populations in the vicinity of Tin City LRRS. The measurement endpoints do not involve any actual field measurements, but are drawn from available toxicity data sources such as Health Effects Assessment Summary Tables (U.S. EPA 1994a), Registry of Toxic Effects of Chemical Substances (RTECS 1994), and Agency of Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles for specific chemicals (ATSDR 1989a, 1989b, 1990, 1991a, 1993a, 1993b, 1993c, 1993d). The measurement endpoints represent sub-lethal, chronic effects on the population of interest. Extrapolation from the assessment endpoints (population level) to the measurement endpoint (individual level) was necessary because no field sampling specific to the ecological risk assessment was conducted (e.g., species abundance or COPEC concentrations in animal tissue).

The measurement endpoint for each COPEC represents the lowest published chronic dose, if available, associated with no adverse effects to the target species. Toxicity values were obtained for 55 of the 66 COPECs (all except 1,3-dichlorobenzene, benzo(g,h,i)perylene, benzo(k)fluroanthene, chrysene, indeno(1,2,3-c,d)pyrene, 1,3,5-trimethylbenzene and four different Aroclors). Using the chronic no observed adverse effects level (NOAEL) represents a conservative approach, in that it can be assumed that doses below the NOAEL should not have any adverse effects on the individual whatsoever. If a NOAEL dose could not be obtained, the lowest observed adverse effects level (LOAEL) or toxic dose low (TDLo) was used instead. LOAEL or TDLo refers to the lowest dose of a substance which is reported to produce any toxic effect. If LOAEL or TDLo values were not available, then the dose lethal to 50 percent of the test population (LD50) or lowest dose reported to cause death in animals (LDLo) was used. LOAEL, TDLo, LD50, and LDLo values were extrapolated to NOAEL-equivalents by the application of uncertainty factors, described in detail in the following subsection.

3.3.3.2 Uncertainty Factors Applied to Measurement Endpoints

Each of the measurement endpoints were derived from a laboratory experiment using a common laboratory mammal, such as a rat or a mouse. The dose of a toxic chemical known to adversely affect a rat or a mouse is likely to be different than the dose that is toxic to any of the key receptor species. Also, the lethal dose in the test species (e.g., LD50) is likely to be higher than the highest dose at which no adverse effects are observed (e.g., NOAEL).

Uncertainty factors (UFs) are often applied to toxicity data in order to extrapolate to the test species of interest. UFs are also used to account for the differences in endpoints for the reported dose (e.g., lethal vs. non-lethal, chronic vs. acute) are from Calabrese and Baldwin (1993). They are listed below:

Extrapolation	UF
Acute to chronic	10
LOAEL to NOAEL	10
LD50 to LOAEL	50

UFs used to account for inter-species differences in the response to a toxic chemical are as follows (Calabrese and Baldwin 1993):

Extrapolation	UF
Species within genus	10
Families within order	60
Orders within class	100
Classes within phylum	1000

An UF of 60 was used for most COPECs in the ground squirrel pathways, an UF of 100 was used for most COPECs in the Arctic fox pathways, and an UF of 1000 was used for most COPECs in the Steller's Eider, Kittlitz's Murrelet and Semipalmated Plover pathways.

UFs are applied by dividing them into the observed doses, thus yielding a dose that is more conservative than the original dose. For example, if the observed NOAEL dose for a mouse was 100 mg/(kg·d), the dose for the Arctic fox would 100/100 = 1 mg/(kg·d) (mice are in order Rodentia and Arctic fox is in order Carnivora; both are in class Mammalia). A list of all toxicity data and UFs used in this ecological risk assessment is provided in Table 3-47.

3.3.4 Exposure Assessment

The exposure assessment describes how the expected dose to which the key receptor species might be exposed was calculated, given the observed environmental concentrations of COPECs. The assessment was done only for the terrestrial environment and not for the marine environment. Additional details for each pathway are provided below.

The five receptor species evaluated in the terrestrial environment were the Steller's Eider, Kittlitz's Murrelet, Semipalmated Plover, Arctic ground squirrel and the Arctic fox. All of the pathways considered are oral routes. The water intake pathway was considered for all five receptors. Plant ingestion was considered for the Arctic ground squirrel and Steller's Eider. Ingestion of soil was considered for ground squirrels, Arctic fox and Steller's Eider. Ingestion of sediment was considered for the Semipalmated Plover and Kittlitz's Murrelet. Two other exposure routes, dermal and inhalation, were not considered to be significant. Dermal exposures to terrestrial animals are typically only considered if the animal swims or burrows (U.S. EPA 1993). Ground squirrels do burrow, but their thick fur minimizes dermal exposure. Also, toxicity data for dermal exposure is unavailable for most of the COPECs. The inhalation exposure route is difficult to quantitate because of the unavailability of respiratory physiology data for the various receptors and the absence of toxicity data specific to inhalation uptake. However, given the large size of the Tin City LRRS area relative to the area potentially contaminated with volatile organics, it is unlikely that the inhalation exposure pathway is of great significance.

3.3.4.1 Dietary Exposure Route

The first step in characterizing the dietary route of exposure was to estimate the concentrations of COPECs in the diet of the Arctic ground squirrel and Steller's Eider. The diet of ground squirrels

consists primarily of dicotyledons (flowering plants), including a wide variety of herbs and shrubs (Sage 1986). Plant food comprises only 13% of the Steller's Eider diet as discussed in Section 3.3.1.4.

Soil contaminant uptake data specific to each of the plant types typically consumed by these animals are not available, so this exposure assessment assumed that all of the plant diet consisted of a generic plant. Not all chemicals would be expected to be taken up by plants. Compounds with a soil/water partition coefficient (K_d) of greater than 1,000 are generally thought to be unavailable for plant uptake by soil sorption (Wang and Jones 1994). K_d can be estimated by $K_{oc} \times f_{oc}$, where K_{oc} is the organic carbon partition coefficient and f_{oc} is the fraction of organic carbon. If K_{oc} could not be located for a specific chemical, then K_{oc} was estimated from K_{ow} using the following formula (Karickhoff 1981):

$$K_{oc} = 0.41 \times K_{ow} \qquad \text{(Equation 9)}$$

Several COPECs had K_d values greater than 1,000, indicating that they do not pose any risk from the dietary route of exposure. These compounds were excluded from any further exposure assessment via the dietary exposure route.

The calculation of the COPEC concentration to be expected in plants used the following equation:

$$SCF = \frac{C_{stem}}{C_{soil}}$$

$$= \frac{\delta}{\delta K_{ow} f_{oc} + \theta} \times (10^{\wedge}0.951 logKow\text{-}2.05) \times (0.784exp\text{-}[\frac{logK_{ow}\text{-}1.78^2}{2.44} \quad] \qquad \text{(Equation 10)}$$

where SCF equals the stem concentration factor (unitless), C_{stem} is the COPEC concentration in the stem of the plant (mg/kg), C_{soil} is the COPEC EPC in the soil (mg/kg), δ is the soil bulk density (g/cm^3), and θ is the soil-water content by volume (ml/cm^3) (Wang and Jones 1994, Briggs et al. 1982, 1983).

Chemical-specific K_{oc} and K_{ow} values were retrieved from several sources (U.S. EPA 1992a, ATSDR 1993a, Mackay 1992, Ali 1984, Montgomery 1990). Values for f_{oc}, δ, and θ were calculated from samples taken from tundra and fill locations at Kotzebue LRRS during the 1994 RI (Tetra Tech 1995). The values used in Equation 10 for these three parameters were 0.0398, 1.89 g/cm^3, and 0.336 ml/cm^3, respectively. For each COPEC, C_{stem} was calculated by rearranging Equation 10 and using the maximum C_{soil} value for each investigative area.

The final step in characterizing exposure via the dietary route is to estimate the daily COPEC dose to the receptors. The following dose equation, modified from U.S. EPA (1993b), was used:

$$ADD_{pot} \quad = \quad C_{stem}\, x\, EF\, x\, NIR_{plant} \qquad \text{(Equation 11)}$$

where ADD_{pot} is the potential average daily dose in mg/(kg·day), EF is the exposure frequency, and NIR_{plant} is the ingestion rate normalized to body weight in kg/(kg·day). Ground squirrels are

present at the site year-round, but during hibernation, they do not eat. These animals hibernate for approximately 220 days/year (Galster and Morrison 1976), thus the EF value was 145/365. The Steller's Eider does not hibernate or migrate, but it is assumed that plants will be available only during the late spring, summer, and early fall months; therefore, an EF value of 182/365 was used.

The calculation of normalized ingestion rate (NIR_{plant}) requires estimates of the receptor's body weight (kg) and plant ingestion rate (kg/d). Plant ingestion rates were estimated from body weight using formulas as presented by Nagy (1987). The body weights and plant ingestion rates used in this calculation are presented in Table 3-48.

3.3.4.2 Water Intake Exposure Route

The second exposure route, considered for all receptors, was the intake of water (i.e., drinking). The following equation for ADD_{pot} from drinking water was used:

$$ADD_{pot} = C_{water} \times EF \times NIR_{water} \qquad \text{(Equation 12)}$$

where C_{water} is the COPEC EPC in surface water (μg/L) and NIR_{water} is the normalized ingestion rate in L/(g·day). A conversion factor of 1 is used (1000 g/kg × 10^{-3} mg/μg) to result in units for ADD_{pot} to be mg/(kg·day). Water ingestion rates for the Steller's Eider, Semipalmated Plover and Kittlitz's Murrelet were estimated using the following formula (Suter 1993):

$$IR = 0.059 \times BW^{0.67} \qquad \text{(Equation 13)}$$

The water ingestion rate for the Arctic fox was estimated by the following formula (Suter 1993):

$$IR = 0.090 \times BW^{1.2044} \qquad \text{(Equation 14)}$$

Where IR is the water ingestion rate in L/day and BW is body weight in kg. The water ingestion rate for the ground squirrel was 0.0531 L/day (EPA 1992b). All body weights and water ingestion rates used in this calculation are presented in Table 3-48.

The Tin City area experiences a harsh, cold climate that results in the ground surface being frozen or snow covered for six to eight months of each year (Tetra Tech 1995). Therefore, a EF value of 182/365 was used for all receptors except for the ground squirrel, which used a EF of 145/365. The risk estimates were prepared based on the receptors drinking water from Cape and Unnamed creeks and not the Bering Sea. While appropriate for the arctic fox and arctic ground squirrel, it may be conservative for the semi-palmated plover.

3.3.4.3 Soil Ingestion Exposure Route

This exposure route was considered for ground squirrels, Arctic fox, and Steller's Eider. The equation for ADD_{pot} from soil ingestion is the following:

$$ADD_{pot} = C_{soil} \times EF \times NIR_{soil} \qquad \text{(Equation 15)}$$

where C_{soil} and NIR_{soil} are the COPEC EPC in soil (mg/kg) and the normalized ingestion rate in kg/(kg·day), respectively. EF values identical to that used for the water ingestion route were used for this exposure route. The percentage of soil incidentally ingested by the ground squirrel was conservatively estimated as 10%, based on Beyer et al. (1992), who calculated soil ingestion rates for small mammals as 2-7.7%. No data specifically addressing sediment ingestion rates were located for the Arctic fox or Steller's Eider. Therefore, it was assumed that these two receptors would ingest soil at a rate similar to that used for the ground squirrel, 10% of food ingested. In all cases, it was conservatively estimated that 100% of the soil ingested would be from the contaminated areas. The risk estimates were prepared based on the receptors living in and frequenting the IRP Source Areas and AOC. However, in most cases, the IRP Source Areas and AOC are gravel pads, which are undesirable living areas and contain a scarcity of food when compared to the nearby tundra areas.

3.3.4.4 Sediment Ingestion Exposure Route

This exposure route was considered for the Semipalmated Plover and Kittlitz's Murrelet. The equation for ADD_{pot} from sediment ingestion is the following:

$$ADD_{pot} = C_{sed} \times EF \times NIR_{sed} \qquad \text{(Equation 16)}$$

where C_{sed} and NIR_{sed} are the COPEC EPC in sediment (mg/kg) and the normalized ingestion rate in kg/(kg·day), respectively. EF values identical to that used for the water ingestion and soil ingestion routes were used for this exposure route. No data specifically addressing sediment ingestion rates were located for the Semipalmated Plover and Kittlitz's Murrelet. In lieu of specific data, the rate of sediment incidentally ingested was assumed to be similar to that estimated for soil ingestion, i.e., 10% of food ingested.

3.3.5 Risk Characterization

Ecological risks for the Tin City LRRS were characterized by the quotient method, which is the most commonly used model for risk estimation (Suter 1993). In this simple one-dimensional scale model, risk is assumed to increase with the magnitude of the quotient according to the following equation:

$$HQ = \frac{ADD_{pot}}{RfD/UF} \qquad \text{(Equation 17)}$$

where HQ is the hazard quotient, ADD_{pot} is the potential exposure dose, and RfD and UF are the reference toxicity doses and uncertainty factors, respectively. For HQs of less than 1, an

assumption is made that the estimated risk from that particular combination of COPEC, location, species, and exposure route is not significant. For HQs greater than 1, there is an indication that the estimated risk could be significant. The quotient method yields information about the potential for adverse effects to a single organism. The results of this method are not intended to be used nor should they be extrapolated to higher levels of biological organization, such as populations or ecosystems.

The uncertainty associated with the calculated HQs was relatively high, because values for several factors had to be extrapolated from other data. Any HQ value greater than 1, while representing a cause for concern, should not be construed as a *de facto* statement of impending ecological decline. Instead, HQ values greater than 1 should help to establish where additional evaluation may be warranted.

3.3.5.1 Dietary Exposure Route

The estimated ecological risks to the Arctic ground squirrel and the Steller's Eider from the dietary pathway are presented in Tables 3-49 and 3-50, respectively. No HQ in any IRP Source Area, AOC, or the background was greater than one for either receptor.

3.3.5.2 Water Intake Exposure Route

The estimated ecological risks to the Arctic ground squirrel, Arctic fox, Semipalmated Plover, Kittlitz's Murrelet, and Steller's Eider from the water intake pathway are presented in Tables 3-51 through 3-55, respectively. For the Arctic ground squirrel, Arctic fox, Kittlitz's Murrelet, and Steller's Eider, none of the detected COPECs had HQ values higher than 1. The Semipalmated Plover had a total HQ of 1.36 at the Beach area. This risk is due in large part to the high UF of 10,000, which results primarily from the UF of 1,000 used to extrapolate the toxicity data from the Class Mammalia to the Class Aves (i.e., from mammals to birds). The HQs for each of the three birds was generally an order of magnitude greater than HQs estimated for the Arctic ground squirrel or Arctic fox.

3.3.5.3 Soil Ingestion Exposure Route

The estimated ecological risks to the Arctic ground squirrel, Arctic fox, and the Steller's Eider from the soil ingestion pathway are presented in Tables 3-56, 3-57, and 3-58, respectively. HQs of greater than 1 were estimated for both the Arctic ground squirrel and Arctic fox at the Lower Camp, Tramway, and Top Camp. Lead represented 86% of the total risk for both the Arctic ground squirrel and Arctic fox. HQs of greater than 1 were estimated for the Steller's Eider at the Lower Camp, Tramway, and Top Camp, Airstrip, and in the background. Specific COPECs with HQs greater than 1 were lead, cadmium, and Aroclor 1254.

3.3.5.4 Sediment Ingestion Exposure Route

The estimated ecological risks to the Kittlitz's Murrelet and Semipalmated Plover from the sediment ingestion pathway are presented in Tables 3-59 and 3-60, respectively. HQs of greater than 1 were estimated for both species at the Beach and Airstrip. Specific COPECs at the Beach with HQs greater than 1 were arsenic, cadmium, chromium, and lead. Chromium represented 85% of the total risk at the Beach.

3.3.6 Summary of Risk Estimates

The only exposure routes for which the estimated total HQ values were greater than 1 were the soil or sediment ingestion pathways for each of the five selected receptors and the water ingestion pathway for the Semipalmated Plover. A total of 17 detected COPECs were evaluated in this baseline ecological risk assessment. Of this total, six chemicals (Aroclor 1254, arsenic, cadmium, chromium, ethylbenzene and lead) were detected at concentrations which resulted in potentially significant risk (HQ > 1).

Table 3-61 summarizes the IRP sites impacted by the COPEC and the exposure pathway. Discussion of the impacted IRP Source Areas follows:

SITE DP 011a: Metals (arsenic, cadmium, chromium, and lead) concentrations at this site resulted in a hazard quotient greater than 1 for the semipalmated plover and Kittlitz's murrelet, based on the sediment ingestion exposure route. At this site, there is no identified source for the metals contamination. A potential explanation for the elevated metals concentrations is the mining activities that took place near this site (U.S. Department of the Interior 1959). American Tinfields operated a mill near the mouth of Cape Creek. Results of spectrographic analyses of selected churn-drill concentrates at Cape Creek showed very high concentrations of all four of the metals of concern at the beach. Chromium represents 85% of the risk at the beach. Results of the spectrographic analyses showed concentrations of chromium to be 100 to 1,000 mg/kg. Chromium was detected at the site in concentrations ranging from 5 to 27 mg/kg. Any spillage of these concentrates during mining activities would explain the elevated levels of metals at the beach. Existing information shows that the Air Force was not involved with any mining activities in this area.

The metals concentrations used in determining risk from sediment ingestion all come from the same sampling location, SW/SD A2. This sampling location is at the deepest point of ponded water located on the beach. It seems unlikely that either one of the receptors would be able to access the sediments at this location.

Site AOC 1: Lead concentrations at this site resulted in a hazard quotient slightly greater than 1 (1.23) for the semipalmated plover based on the water intake exposure route. The primary source of contamination at this site is gasoline spills or leaks from the fuel pump house. The high concentration of lead found in the surface water at this site could be related to leaded gasoline or to the mining activities.

Site AOC 2: Concentrations of lead at this site resulted in a hazard quotient greater than 1 for the Arctic fox, Arctic ground squirrel, and Steller's eider for soil ingestion; and concentrations of Aroclor 1254 resulted in a hazard quotient greater than 1 for Steller's eider, based on the soil ingestion exposure route. All the concentrations used at this site came from sampling location SS I1. The primary source of contamination at this site is an above-ground storage tank. It is unusual that both lead and PCBs would be present at the same location if there is only one source. The elevated concentrations come from one isolated location and, therefore, probably do not pose a significant risk when looking at the area as a whole.

Site ST 12c: Concentrations of ethylbenzene at this site resulted in a hazard quotient slightly greater than 1 (1.09) for the semipalmated plover based on the sediment ingestion exposure route. The primary source of contamination for this site is the diesel fuel tank. It is likely that elevated concentrations of ethylbenzene are due to the diesel fuel spills and leaks at this site.

Site SS 13a: Concentrations of cadmium at this site resulted in a hazard quotient slightly greater than 1 (1.22) for the Steller's eider, based on the soil ingestion exposure route. There does not appear to be a source of cadmium or petroleum at this site. Three locations were tested for metals at this site, revealing cadmium ranging from ND to 0.8 mg/kg. The hazard quotient for cadmium, using the highest concentration of 0.8 mg/kg, is very close to 1 (1.22). If the average concentration from the three sampling locations was used, the hazard quotient would be less than 1. Also, the areal extent of cadmium contamination is small.

3.3.6.1 Background Risk Estimate

Risk estimates for background data were developed in order to compare background ecological risk levels to risks attributable to activities at Tin City LRRS. The risk levels estimated from COPECs detected in background samples ranged from two orders of magnitude less than to slightly greater than risks estimated from the Beach area, Airstrip, and Lower Camp, Tramway and Top Camp.

3.3.7 Uncertainty Analysis

The risk estimates provided in Section 3.3.5 are based upon a number of assumptions which can not be disproved in the absence of site-specific data. Nonetheless, a qualitative assessment of the uncertainty of these estimates can be made. This section discusses the primary areas of uncertainty for each of exposure pathways examined. The areas of uncertainty include exposure frequency, exposure point concentrations, size of the sampling results database, contaminant uptake into plants, soil or sediment ingestion rates, toxicity data, and soil/sediment RBC conversion. Each is discussed in detail in the following paragraphs.

3.3.7.1 Exposure Frequency

The exposure frequency for Arctic ground squirrels (145 days/year) assumed that the squirrel would be potentially exposed to COPECs during the entire time it was not hibernating. This is a reasonable assumption for squirrels located within Tin City LRRS because the home range of the Arctic ground squirrel is approximately 100 square feet from the site of its burrow. The exposure frequency for the other receptors (Arctic Fox, Steller's Eider, Semipalmated Plover, and the

Kittlitz's Murrelet) assumed that they would be potentially exposed to COPECs during the entire late spring, summer, and early fall (182 days/year). However, each of the other four receptors may be reasonably expected to range in an area much greater than the immediate vicinity of Tin City LRRS; therefore, the exposure frequency for the receptors other than the Arctic ground squirrel is likely overstated.

3.3.7.2 Exposure Point Concentrations

As discussed in section 3.3.2.2, the maximum compound concentrations measured at any one site were used in the risk estimate calculations for that site. If the maximum measured concentration at any one site was significantly greater than the other measured concentrations at that same site, the risk may be overstated. For example, lead concentrations measured in sediment samples taken at three locations at DP 011 were 5, 28, and 118 mg/kg. The value of 118 mg/kg was used to estimate ecological risks from this site. This conservative approach may not be entirely representative of the site and may overstate the risks.

3.3.7.3 Chemical Database

The sampling database used to quantify the chemical concentrations at Tin City LRRS was small, with a small number of detects. If a greater number of samples had been collected and analyzed, it is highly probable that these results would also contain a large amount of additional non-detects. It is therefore likely that the actual concentration of a chemical at a particular site is overstated.

3.3.7.4 Contaminant Uptake into Plants

The dietary exposure assessment estimated the COPEC concentrations in a hypothetical plant. Whether this hypothetical plant bears any similarity to actual vegetation consumed by the ecological receptors is very difficult to determine. Contaminant uptake by plants is dependent on many different factors specific to the plant species, including lipid, wax, and water contents and transpiration rates (Paterson et al. 1994), and has been the subject of many different models (e.g., Behrendt 1993). The SCFs calculated for this baseline ecological risk assessment may differ from the true contaminant uptake factors for dietary species consumed by the ground squirrel and Steller's Eider by one or more orders of magnitude.

3.3.7.5 Soil and Sediment Ingestion Rates

The percentage of soil or sediment in the diet represents a major area of uncertainty. The percentage chosen (10 percent) is probably an overestimate of the true value, based on the fact that the dietary soil content in a number of small mammals was no higher than 7.7 percent.

In lieu of specific sediment ingestion rates for the semipalmated plover, a rate of 10% of food ingested was used, since another more appropriate reference was not found during the literature review. This was based on a soil ingestion rate calculated for small mammals. Using this rate introduces uncertainty because the semipalmated plover, feeding along the sea, forages in the sediment for much of its food (small crustaceans, mollusks, and mosquito larvae).

3.3.7.6 Toxicity Data

An additional area of uncertainty is the derivation of a reference toxicity dose, which was addressed by the use of uncertainty factors as discussed in Section 3.3.3.2. Application of more than one UF to a particular species, while being conservative, also significantly increases the degree of uncertainty. This is particularly true for the Steller's Eider, Semipalmated Plover, and the Kittlitz's Murrelet. No toxicity data were located for the class Aves (birds), which resulted in application of an UF of 1,000. Further application of UFs to account for differences in endpoints for the reported dose (e.g., lethal vs. non-lethal, chronic vs. acute) resulted in typical total UFs of 10,000.

3.3.7.7 Soil/Sediment RBC Conversion

Because the TOC content of soils at Tin City LRRS was not measured, the average TOC value from Kotzebue LRRS was used. Both Tin City LRRS and Kotzebue LRRS are located along the Bering Sea and have similar physiography. However, the two facilities may not have identical TOC values. Because the TOC content was used to adjust the RBCs, there exists the possibility that some COPEC were included when they did not need to be, or not included when they should have been.

3.3.8 Ecological Risk Assessment and Conclusions

The quantitative portion of the baseline ecological risk assessment evaluated the ecological risks based on the concentrations of COPEC in the IRP Source Areas and AOC. However, with the exception of DP 011a and DP 011b, all of the IRP Source Areas and AOC are located on gravel pads and are infrequently used by wildlife. The gravel pad provides poor habitat for wildlife. The absence of vegetation results in a scarcity of food sources and cover from predators. Wildlife tends to populate the nearby tundra.

While the risk to each individual is important in evaluating human health risks, in ecological risk evaluations, the species population as a whole, rather than an individual, is important, except for endangered species.

The IRP Source Areas and AOC comprise only a small fraction of the whole Tin City LRRS site (less than 0.05 percent). Risk to the ecology of the whole site is not appropriately portrayed by the quantitative ecological risk assessment.

Ecological receptors are typically not present in the gravel pads, so the pathway for risk is incomplete for soil and sediment ingestion, except for DP 011a and DP 011b. Even if the soil and sediment ingestion pathways were complete, the overall impact to the Tin City LRRS would be mitigated significantly due to the small portion of the LRRS that is IRP Source Areas and AOC.

Disruption of the local habitat, especially nesting or feeding locations of Species of Special Concern, due to remedial actions is undesirable and may cause adverse impacts in excess of those attributable to contamination.

4.0 FEASIBILITY STUDY

4.1 SITE CHARACTERIZATION

In accordance with the Scope of Work, the Feasibility Study consists of brief recommendations for appropriate treatment technologies based on best professional judgment.

4.1.1 Source Area: DP 011a

This site contains low levels of petroleum products apparently released from abandoned drums and machinery on the ground and in surrounding ponded surface water (Figure 3-2). The drums were removed from the site during the 1995 removal action and no known on-going source of contamination remains. Petroleum products were detected in the pond sediments, but site-specific factors all suggest that the petroleum products are very weathered and that biodegradation has occurred and will continue to decrease the concentrations of hydrocarbons. Identifiable SVOC and VOC, including common risk drivers, such as benzene and naphthalene, were not detected. Furthermore, the petroleum products in the sediment were present at concentrations below the site-specific ADEC limits.

Arsenic, barium, cadmium, chromium, lead, selenium were detected at the site at levels comparable to the background concentrations. Based on existing information in this report, it is recommended that this site be closed with no further response action planned.

4.1.2 Source Area: DP 011b

This site contains low levels of petroleum products due to the presence of abandoned drums in nine discrete areas in tundra areas along the beach, Tin City mine site and fuel pump house at Bldg. 123 (Figures 1-9 through 1-19). The drums were removed from the site during the 1995 removal action and no known on-going source of contamination remains. Petroleum products are present in soils significantly above the site-specific ADEC limits, although few identifiable VOCs and SVOCs were detected. The human health risk assessment results show that the risk attributable to detected compounds is below the EPA threshold of 1.0E-6. However, the high laboratory detection limits limited the conclusions that could be drawn concerning the risks due to compounds that were not detected.

The risks to human health were definitely quantified as below 1.76E-4, with most of the risk attributable to dermal contact. Additional information would be necessary to definitively show risks below the EPA threshold of 1.0E-6. Similarly, the ecological risk assessment numerical results show elevated levels of risk due to ingestion of soils. Additional information would be necessary to remove the many levels of conservatism from the risk assessment and definitively show whether or not the existing contamination presents a risk to wildlife. In both cases, eliminating the pathway for contact with surface soils may be more cost effective than collecting additional data.

In the stained areas typical of DP 011b, the petroleum products cause the tundra soils to be sticky and gooey, which, in Air Force experience at Kotzebue, can potentially result in a physical hazard to wildlife that frequent the area, such as fouling wildlife feet, fur, or feathers with petroleum. The stained areas are present in the tundra and are likely to be common habitat for wildlife such as the ground squirrel, arctic fox and semipalmated plover. Visually contaminated soils will be excavated to remove them from areas frequented by people (i.e., adjacent to the road to Wales) and wildlife (i.e., in tundra). The shallow excavations will be backfilled with clean fill that has been procured locally. Excavated soils will be mixed with gravels (in a range of 1:1 to 1:10 soil to gravel) and used for dust suppression in on-site and/or runway maintenance.

To minimize the potential for even minimal contaminant migration, road/runway maintenance will be limited to areas that are:

- On site and operated and maintained by the Air Force
- Free of ponded surface water
- Free of surface drainages that lead to surface water
- Not located in the Cape Creek drainage

After the road maintenance is complete, the area will be monitored. If migration of petroleum constituents to receptors is occurring, corrective action will be instituted to remedy the situation.

4.1.3 Source Area: AOC 1

This site is contaminated with petroleum products due to spills or leaks at the fuel pump house at Bldg. 123, as shown on Figure 3-2. The fuel pump house has been taken out of service and all stored fuel has been removed. The absence of benzene and limited concentrations of other VOCs and SVOCs suggests that natural attenuation of the petroleum products is occurring at this site. Concentrations of petroleum products at this site do exceed the site specific ADEC matrix levels, however, in both surface and subsurface soils the risk assessment shows that there is not a significant threat to human health or the environment. Minimal contact of wildlife is expected with the gravel pad, since the barren gravel pad is an less-desirable habitat for wildlife than the nearby tundra, where sources of food and cover are more abundant. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.4 Source Area: ST 12a

This site contains low levels of petroleum products due to leaks from UST #3 (Figure 3-3). This tank has been removed and no known on-going source of release to the environment remains. The contamination is limited to the subsurface soils and no pathways for migration to the surface were identified. The absence of benzene and low levels of other VOCs and SVOCs suggests that natural attenuation of the petroleum products is occurring at this site. Concentrations of petroleum products at this site do exceed the site specific ADEC matrix levels, however, the risk assessment shows that there is not a significant threat to human health or the environment. There are no potential receptors at this site and apparently no potable ground water. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.5 Source Area: ST 12b

This site contains low levels of petroleum products due to UST #20 which has been removed (Figure 3-4). There is no surface contamination at this site. Historical levels of petroleum products present at the site exceed the site-specific ADEC limits while current levels do not. The absence of identifiable VOCs and SVOCs suggests that natural attenuation of petroleum products is occurring at the site. None of the common risk drivers such as benzene and naphthalene were detected at this site. Natural attenuation should continue due to the low levels of petroleum products and the removal of the source of contamination. The risk assessment demonstrates that subsurface petroleum contamination at this site does not pose a risk to human health or the environment.

Arsenic was detected at the site at levels comparable to the background concentrations. The background levels were found to contribute to elevated risk at the site. Site background concentrations are associated with rich veins of tin and platinum that have brought miners to the area. However, there is no indication that the metals are above naturally-occurring background levels and no indication that the Air Force took part in mining operations. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.6 Source Area: SS 13a

This site contains low levels of petroleum products due to a spill or leak from a single buried drum (Figure 3-5). The areal extent of contamination suggests that the source would be larger than a single drum and may include historical releases from other unidentified sources. Low levels of identifiable VOCs and SVOCs suggests that there is no significant ongoing source of contamination and that natural attenuation of petroleum products is occurring at the site. Concentrations of petroleum products at this site do exceed the site specific ADEC matrix levels, however, in both surface and subsurface soils the risk assessment shows that there is not a significant threat to human health or the environment. There is no evidence of potable ground water at this site.

Similar to other areas of the site, arsenic was detected at the site at levels comparable to the background concentrations. The background levels were found to contribute to elevated risk at the site. Site background concentrations are elevated due to rich veins of tin and platinum that have brought miners to the area. However, there is no indication that the metals are above naturally-occurring background levels and no indication that the Air Force took part in mining operations. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.7 Source Area: SS 13b

This site was investigated for contamination from transformers formerly sited on a concrete pad (Figure 3-5). Very low levels of PCBs (ppt) were detected in wipe samples from the concrete pad but no PCBs were detected in the surrounding soil. Wiping the pad with the solvent hexane released only minimal amounts of PCBs. The minute amounts of PCBs on the concrete pad are weathered and unlikely to adhere to humans or wildlife due to occasional casual contact with the

concrete surface. The gravel pad is not a likely habitat for wildlife due to the absence of a food source and cover. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.8 Source Areas: SS 14a and SS 14b

These two source areas were combined into one area since the contamination was commingled and could not be attributed to a single source (Figure 3-6). The site contains petroleum products apparently due to leaks from either the three USTs or the one AST. Low levels of VOCs and SVOCs suggests that natural attenuation of the petroleum products is occurring at this site. Concentrations of petroleum products at this site do exceed the site specific ADEC matrix levels, however, in both surface and subsurface soils the risk assessment shows that there is not a significant threat to human health or the environment. No sources of potable ground water have been identified at the site. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.9 Source Area: AOC 2

There are two separate locations of contamination at this site (Figure 3-5). One is a small area of stained soil near the door to the deactivated sub station. This location contains very low levels of petroleum products which are below the most stringent site specific ADEC matrix levels. PCBs were detected at a second isolated stained area at this location at a concentration of 2.0 mg/kg total PCBs. The human health risk assessment shows a risk of 1.02E-% and 1.66E-5 for children and adults, respectively, due to dermal contact with soil. The site-specific risk assessment made a number of very conservative assumptions. For example, the extent of PCB-contaminated soil was not taken into account when assessing dermal contact, so the risk assessment conservatively assumes that all dermal contact with soil is at the AOC. None of the site personnel live at the AOC, and it is not frequented by recreational or subsistence users, so this assumption is extremely conservative, since PCB contamination is limited to an estimated 1 cubic yard of material.

EPA Region III risk-based concentrations for residential soils is 5.5 mg/kg, and can be used without more in-depth calculations to show that the levels of PCBs at the site do not pose a risk to human health. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.10 Source Area: AOC 3

This site contains one location with elevated petroleum products and one location where PCBs were detected (Figure 3-3). The contamination is near the abandoned substation. The PCBs detected were at a concentration of 3.2 mg/kg, which is within typical clean-up levels. . The human health risk assessment shows a risk of 1.02E-5 and 1.66E-5 for children and adults, respectively, due to dermal contact with soil. The site-specific risk assessment made a number of very conservative assumptions. For example, the extent of PCB-contaminated soil was not taken into account when assessing dermal contact, so the risk assessment conservatively assumes that all dermal contact with soil is at the AOC. None of the site personnel live at the AOC, and it is not

frequented by recreational or subsistence users, so this assumption is extremely conservative, since PCB contamination is limited to an estimated 1 cubic yard of material.

EPA Region III risk-based concentrations for residential soils is 5.5 mg/kg, and can be used without more in-depth calculations to show that the levels of PCBs at the site do not pose a risk to human health. Based on existing information in this report it is recommended that this site be closed with no further action.

4.1.11 Source Area: ST 12C

This site contains elevated levels of petroleum products due to leaks from a UST which has been removed (Figure 3-7). A nearby snow removal site has created the presence of surface water ponds. The presence of the surface water apparently has allowed the petroleum products to migrate to the sediment. There is no benzene at the site and concentrations of other VOCs and SVOCs are low, suggesting that natural attenuation is occurring over time. Concentrations of petroleum products at this site do exceed the site specific ADEC matrix levels, however, in both surface and subsurface media, the risk assessment shows that there is not a significant threat to human health or the environment. The snow storage area has been relocated to eliminate the driving force behind the petroleum migration. Further remedial action will consist of intrinsic remediation or horizontal bioventing.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CATEGORIZATION OF SITES

Based on the results of past investigations, the 1995 remedial investigation documented in this report, the 1995 removal action by ACCI, Inc., and ecological and human health risk assessments, the seven IRP Source Areas, and AOC were each placed in one of two categories. The categories consist of:

- No further response action planned (NFRAP) because no significant impact to human health or the environment was identified.

- Remedial action recommended based on the available information.

Five of the seven IRP Source Areas and AOC were identified for NFRAP, which requires no further action. These areas are:

- SS 13 (both a and b), the Spill/Leak #3
- SS 14 (both a and b), 3 UST and AST #10
- AOC 1, Spill/Leak #5 at the fuel pump house at Bldg. 123
- AOC 2, Fuel tanks at Top Camp substation
- AOC 3, Substation at Lower Camp

The following two areas were identified for remedial action:

- ST 12, Four USTs (one previously closed)
- DP 011, Dump No. 3 at the beach

ST 12 consists of four tanks in separate locations across the site. Tank #9 was closed in 1993. Soils associated with tanks #3, #16 and #20 were investigated in 1995. Based on the 1995 investigation, closure and NFRAP is recommended for Tanks #3 and #20. The contaminated soils associated with the former location of Tank #16, at the weather station and airstrip, were retained for remedial action because of the migration of dissolved phase petroleum constituents into the tundra at two distinct locations. An administrative control, the discontinuation of the use of the contaminated gravel pad for the stockpiling of snow was instituted. Intrinsic remediation or horizontal bioventing will be implemented.

For investigation purposes, DP 011, Dump No. 3 at the beach, was subdivided into two parts– DP 011a, the ponded surface water and sediments; and DP 011b, nine areas from which abandoned drums have been removed. No further response action is planned for the ponded surface water and sediments. Due to the potential physical hazards associated with the sticky petroleum products remaining in the tundra and inability to quantify the risks attributable to non-detected compounds using the existing data, remedial action is planned consisting of excavation of visually contaminated soils, and mixing the soils with gravel and using the mixture for road and/or

runway maintenance and dust control. Excavations will be filled with clean fill that has been procured locally.

At several locations, arsenic, cadmium, chromium, lead and selenium and PCBs were detected in some samples from the site. In some cases, the concentrations elevated risk levels above the commonly accepted benchmarks of 10^{-6} for carcinogens and 1.0 for non-carcinogens. In all cases, however, both the arsenic and PCB levels were comparable to documented site background levels. Elevated concentrations of metals are not surprising since the Tin City LRRS is adjacent to many tin and platinum mining claims, and elevated levels of metals are expected in mining areas. Therefore, the levels of metals detected at the site are neither surprising nor alarming. The Air Force was not involved with mining activities in the vicinity of Tin City LRRS.

5.2 REMEDIATION

A portion of one area, ST 12, was retained for remedial action. Throughout this report, this area has been referred to as ST 12c. The scope of remedial action involves relocation of the snow storage area and horizontal bioventing or intrinsic remediation to arrest migration of petroleum constituents into tundra and ponded surface waters adjacent to the petroleum-contaminated pad, which was the former location of UST #16. The area is located at the airstrip. For most of the year, the site is frozen and all migration is arrested. Migration to the adjacent tundra and ponded surface water is only relevant during unfrozen periods of spring, summer and fall.

Backgound site soil samples indicated that naturally-occurring organics in the tundra and peat samples result in elevated levels of TPH-diesel range. Any future sampling would benefit from evaluating how the contribution of naturally-occurring organics will be quantified and differentiated from petroleum constituents in soil and surface water.

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Figures

Source: U.S. Geological Survey
Reston, Virginia 22092
National Atlas, Northern Alaska
Compiled 1967, Revised 1973
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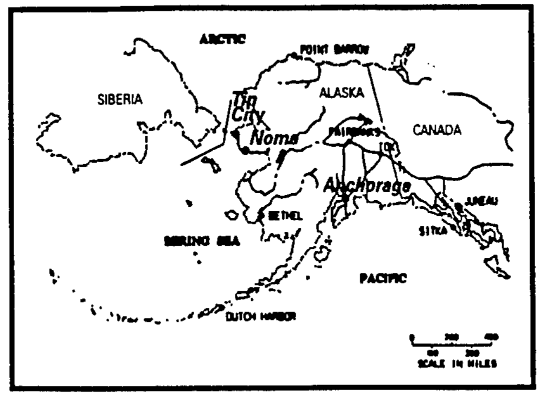

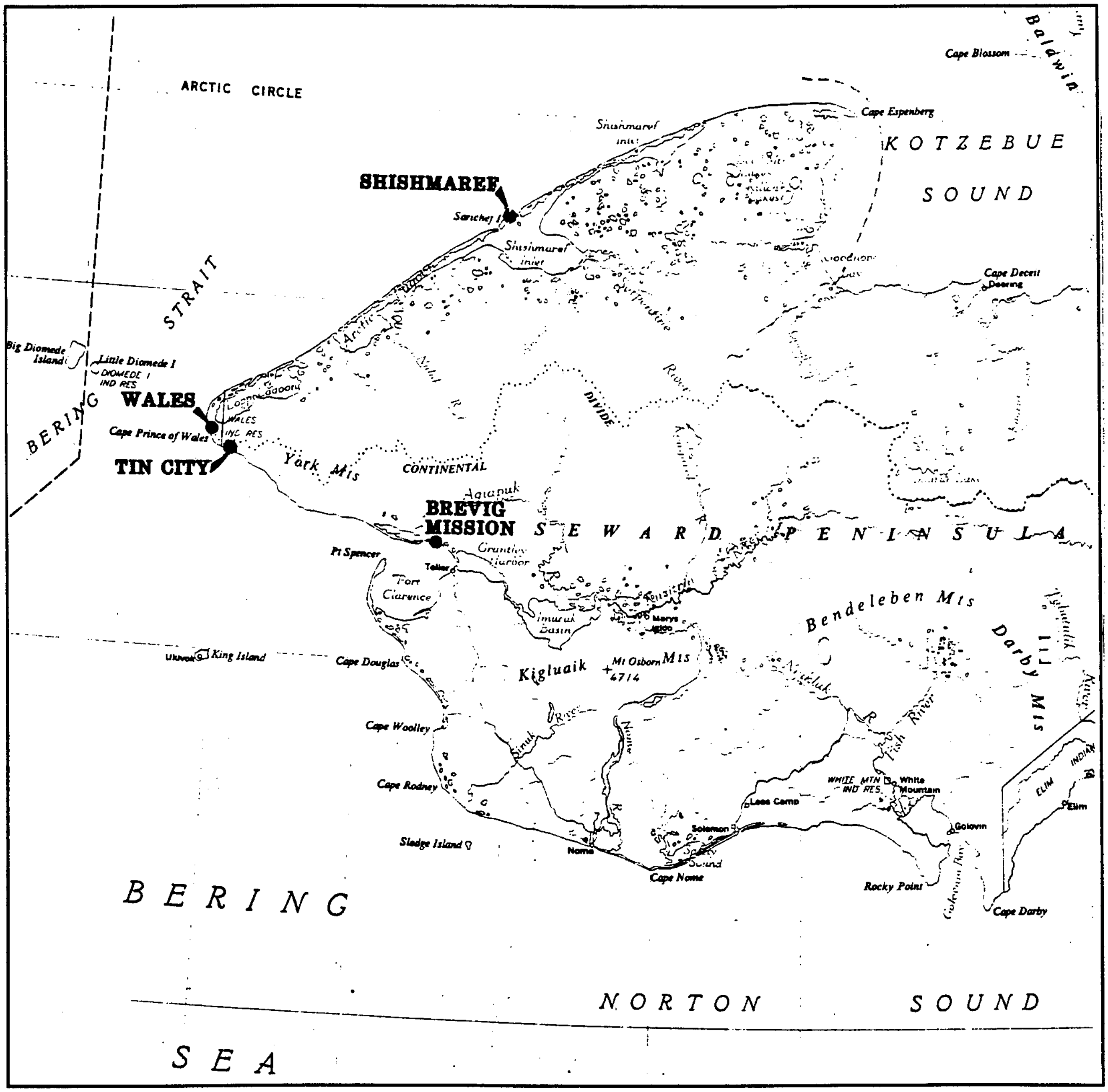

FIGURE 1–1

TIN CITY LRRS, ALASKA

PROJECT LOCATION

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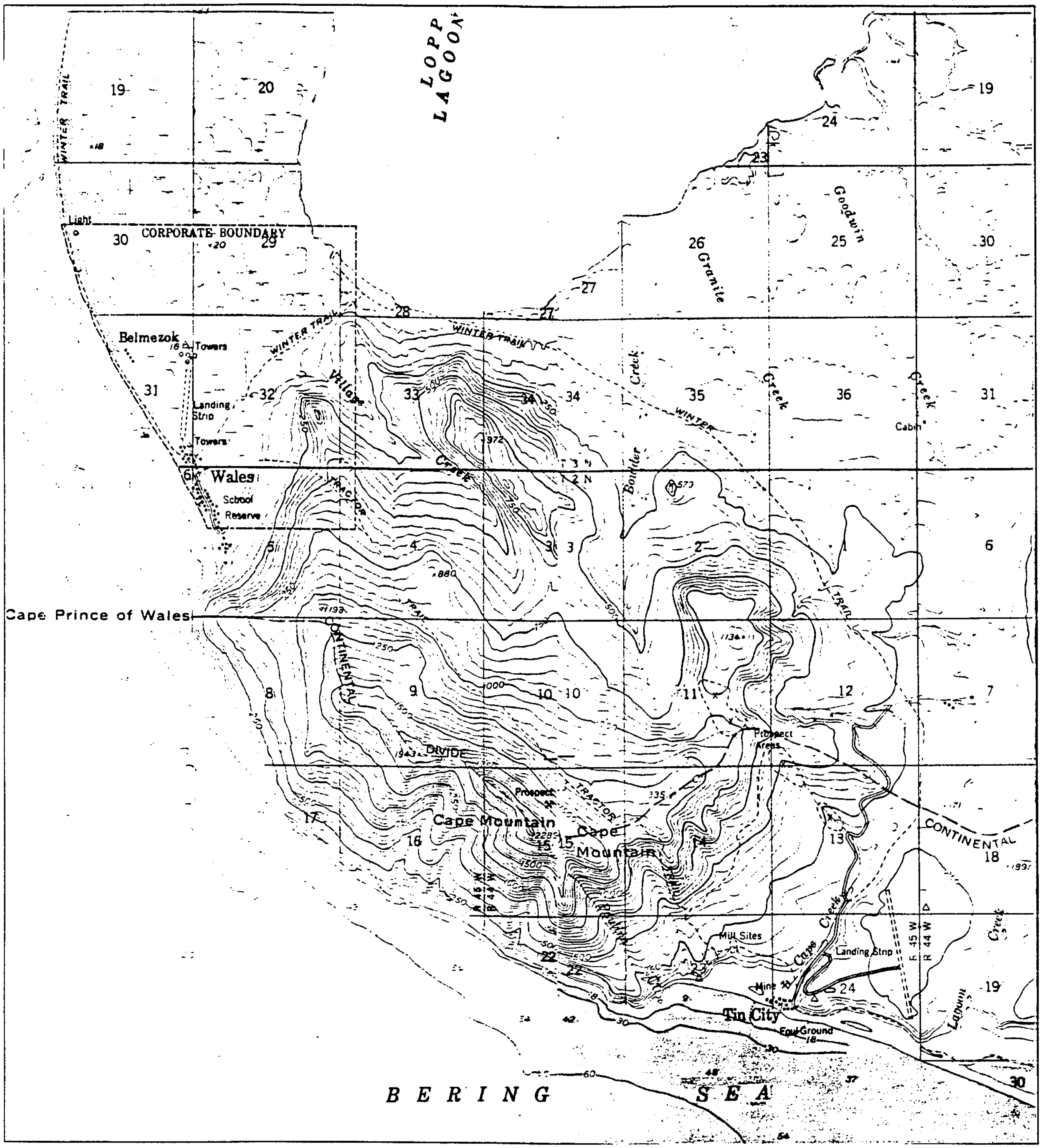

Source: U.S. Geological Survey
Reston, Virginia 22092
Teller (C–6 & C–7), Alaska
1950, Minor Revisions 1982
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FIGURE 1–2

TIN CITY LRRS, ALASKA

GENERAL PROJECT AREA

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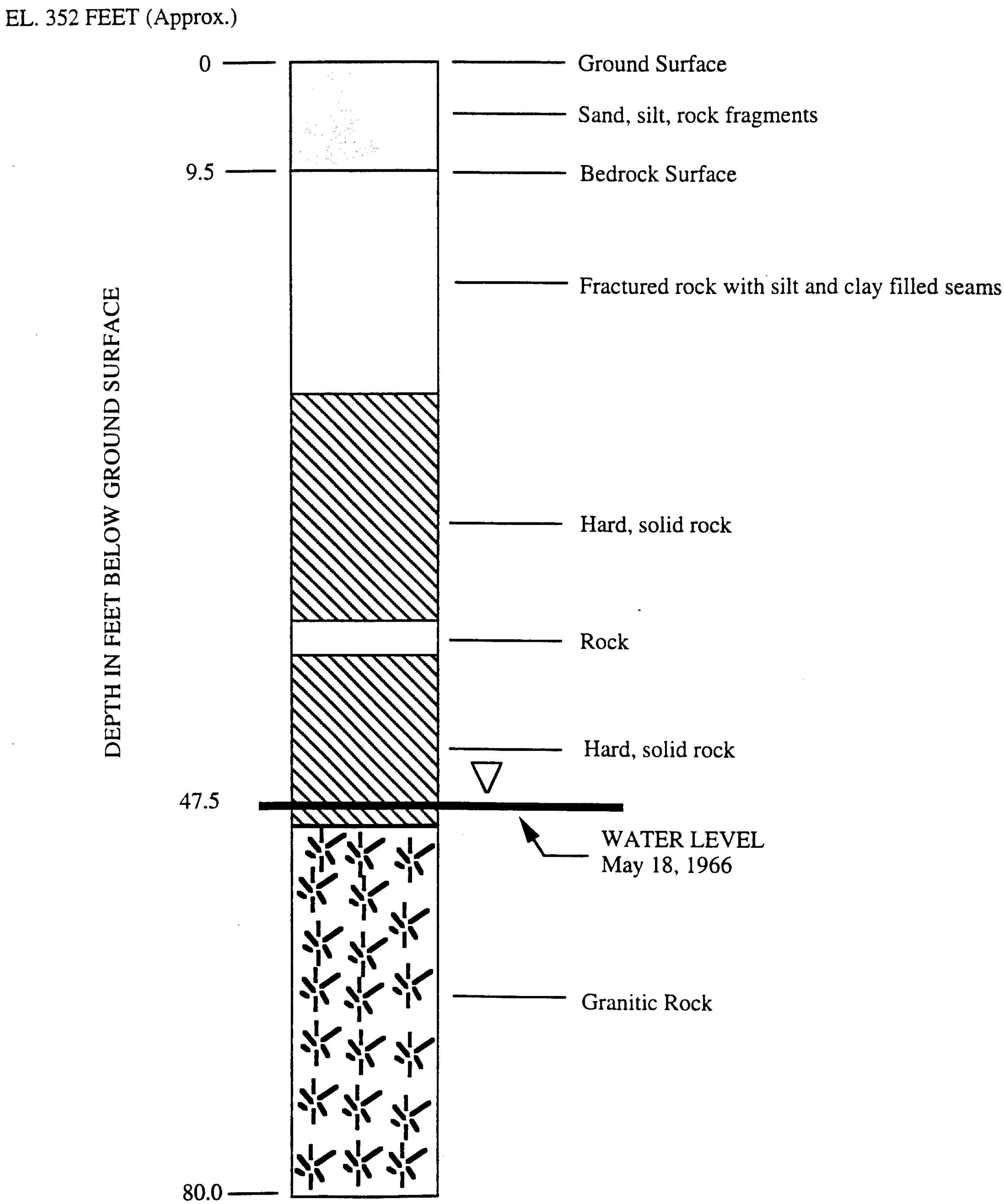
FIGURE 1-3

TIN CITY LRRS WELL LOG
Well No. 4



SOURCE: MODIFIED FROM US GEOLOGICAL SURVEY WATER RESOURCES DIVISION FILE DATA, UNDATED.

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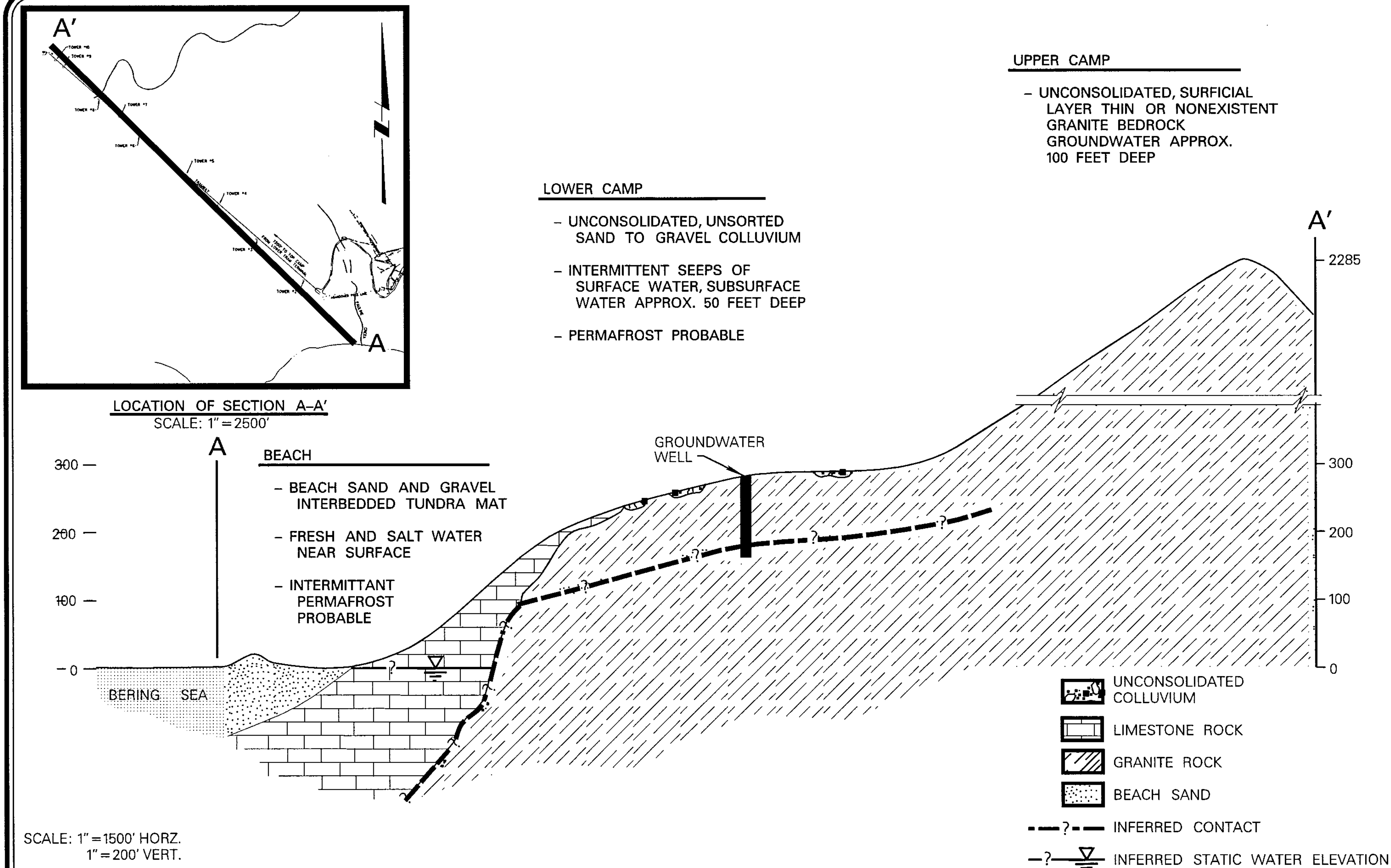

FIGURE 1–4

TIN CITY LRRS, ALASKA

CROSS SECTION SHOWING INFERRED GENERALIZED GEOLOGY AND HYDROGEOLOGY OF THE BEACH, LOWER CAMP, TRAMWAY, AND TOP CAMP AREAS

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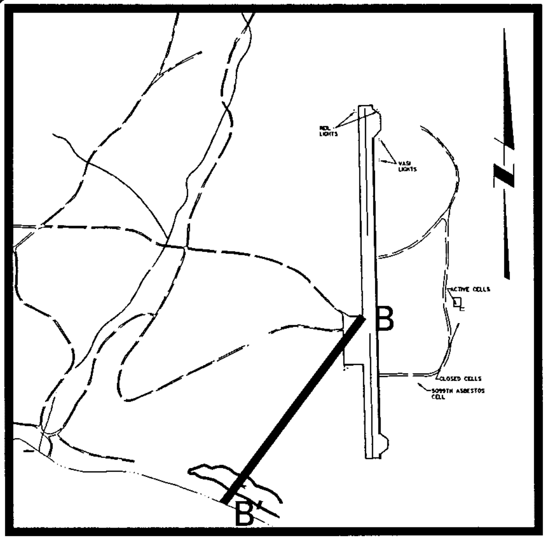
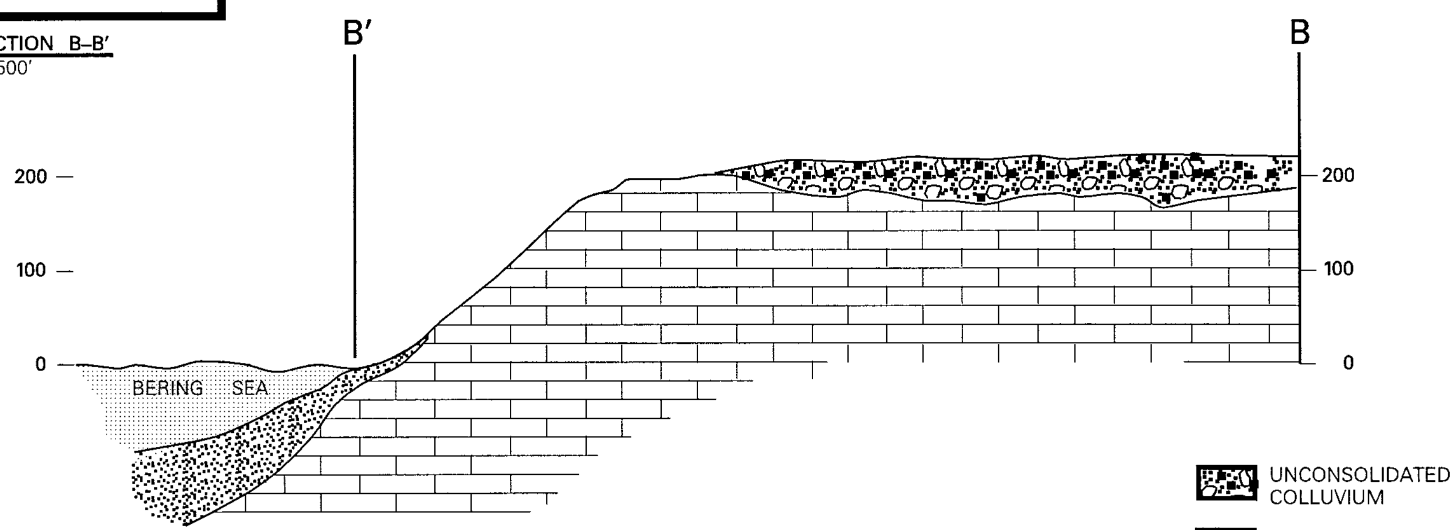


LOCATION OF SECTION B–B'
SCALE: 1" = 2500'

AIRSTRIP /WEATHER STATION

- UNCONSOLIDATED COLLUVIUM OVER LIMESTONE
- SURFACE WATER SEEPS GROUNDWATER ELEVATION UNCERTAIN
- PERMAFROST PROBABLE

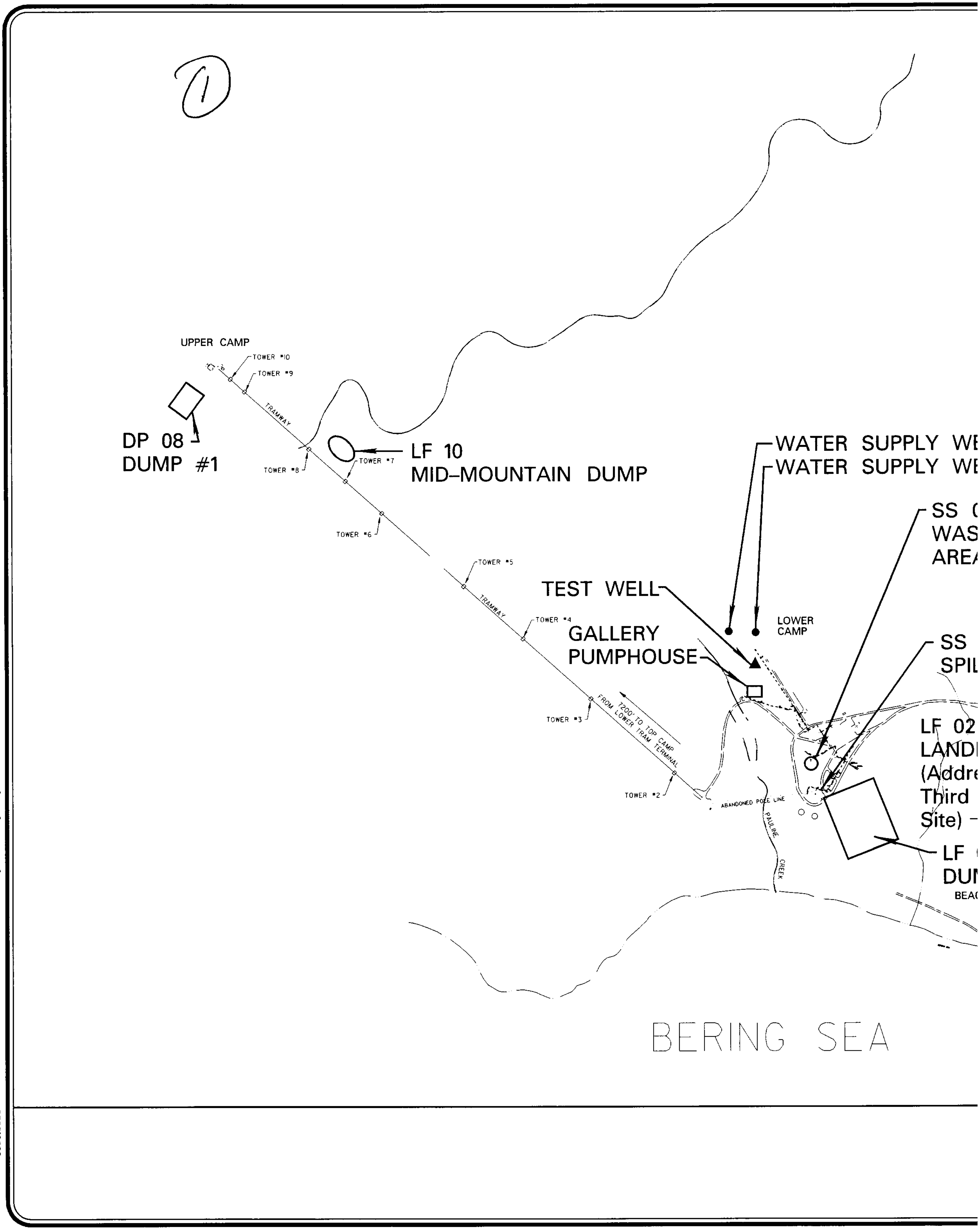


SCALE: 1" = 600' HORZ.
1" = 200' VERT.

FIGURE 1–5

TIN CITY LRRS, ALASKA

CROSS SECTION SHOWING INFERRED GENERALIZED GEOLOGY AND HYDROGEOLOGY OF AIRSTRIP



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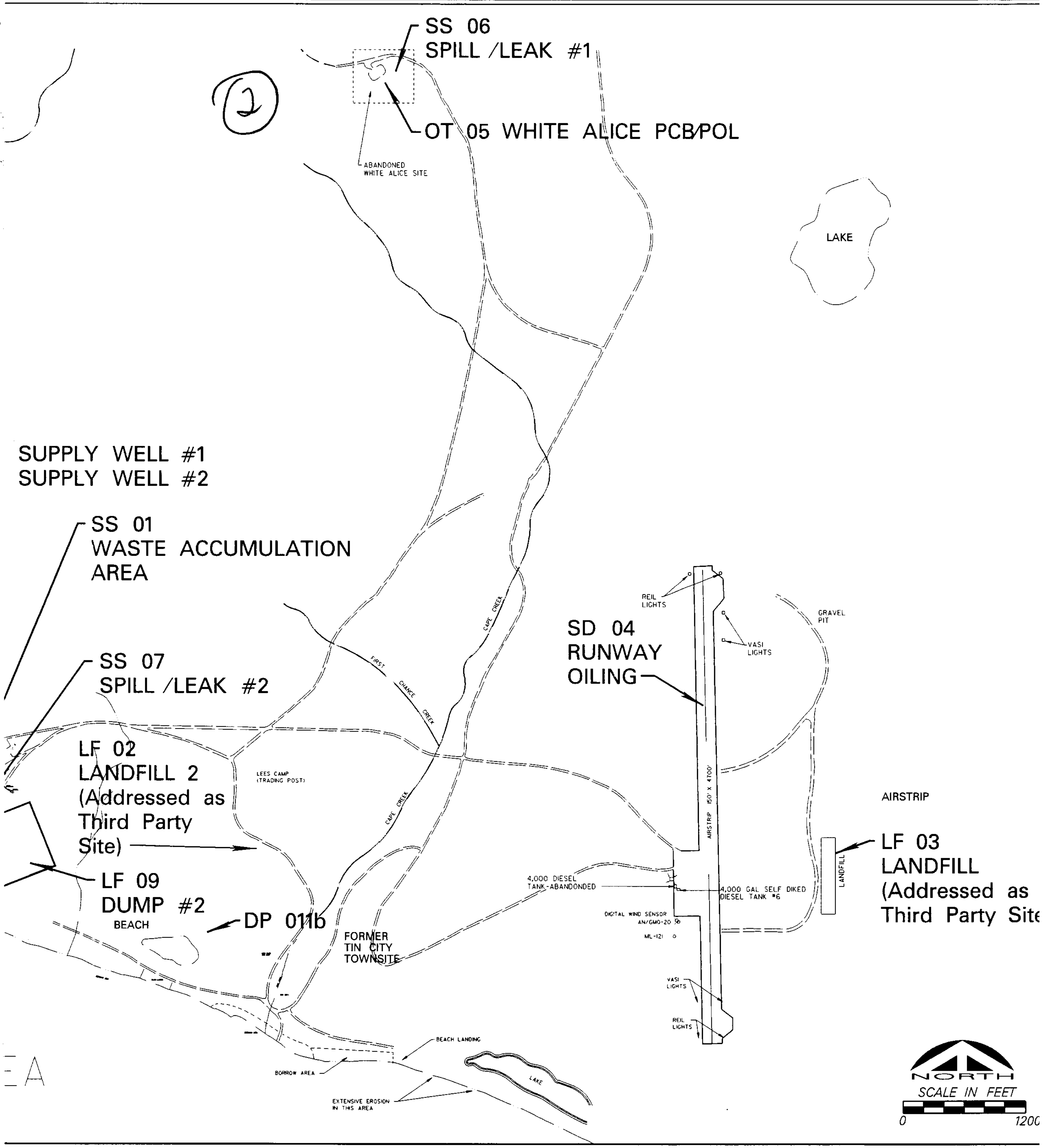


FIGURE 1–6

TIN CITY LRRS, ALASKA

NO FURTHER RESPONSE ACTION PLANNED (NFRAP) IRP SITES

(3)

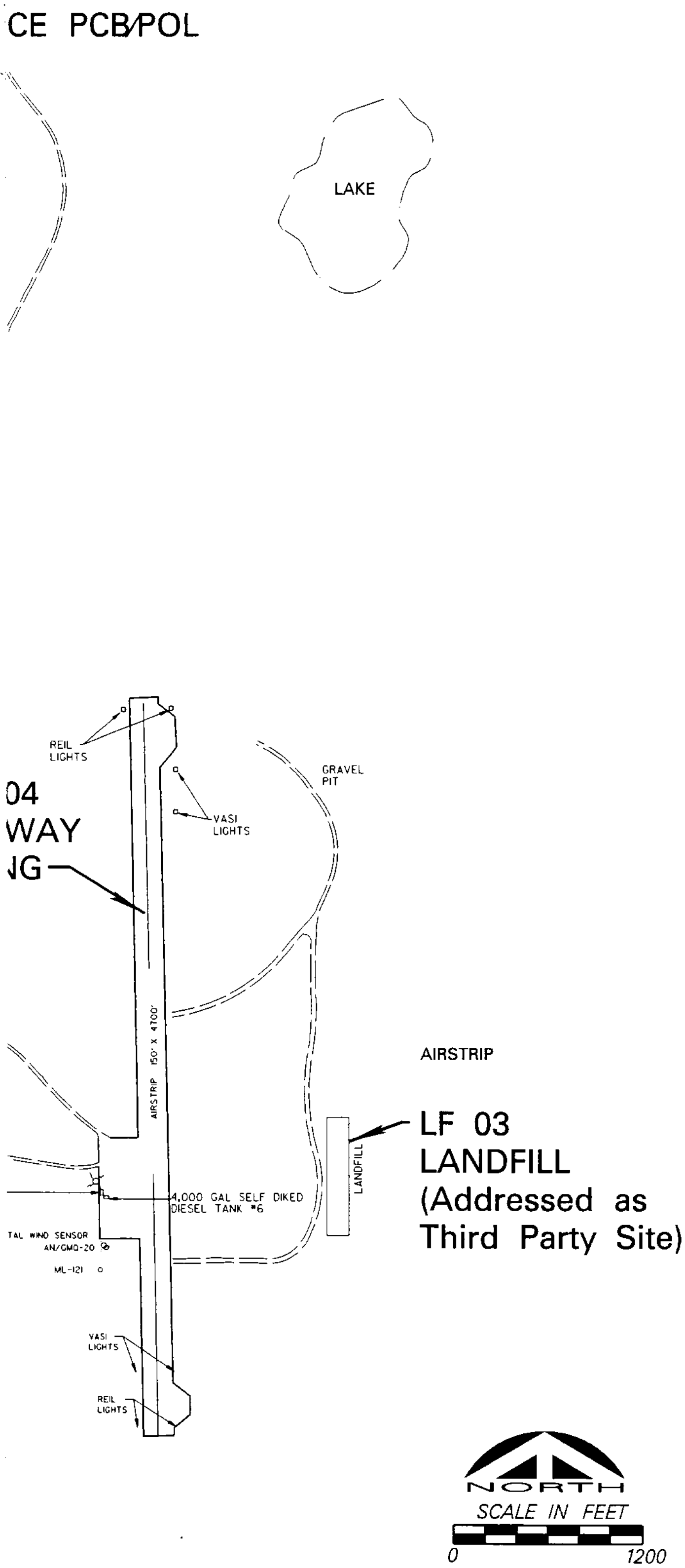
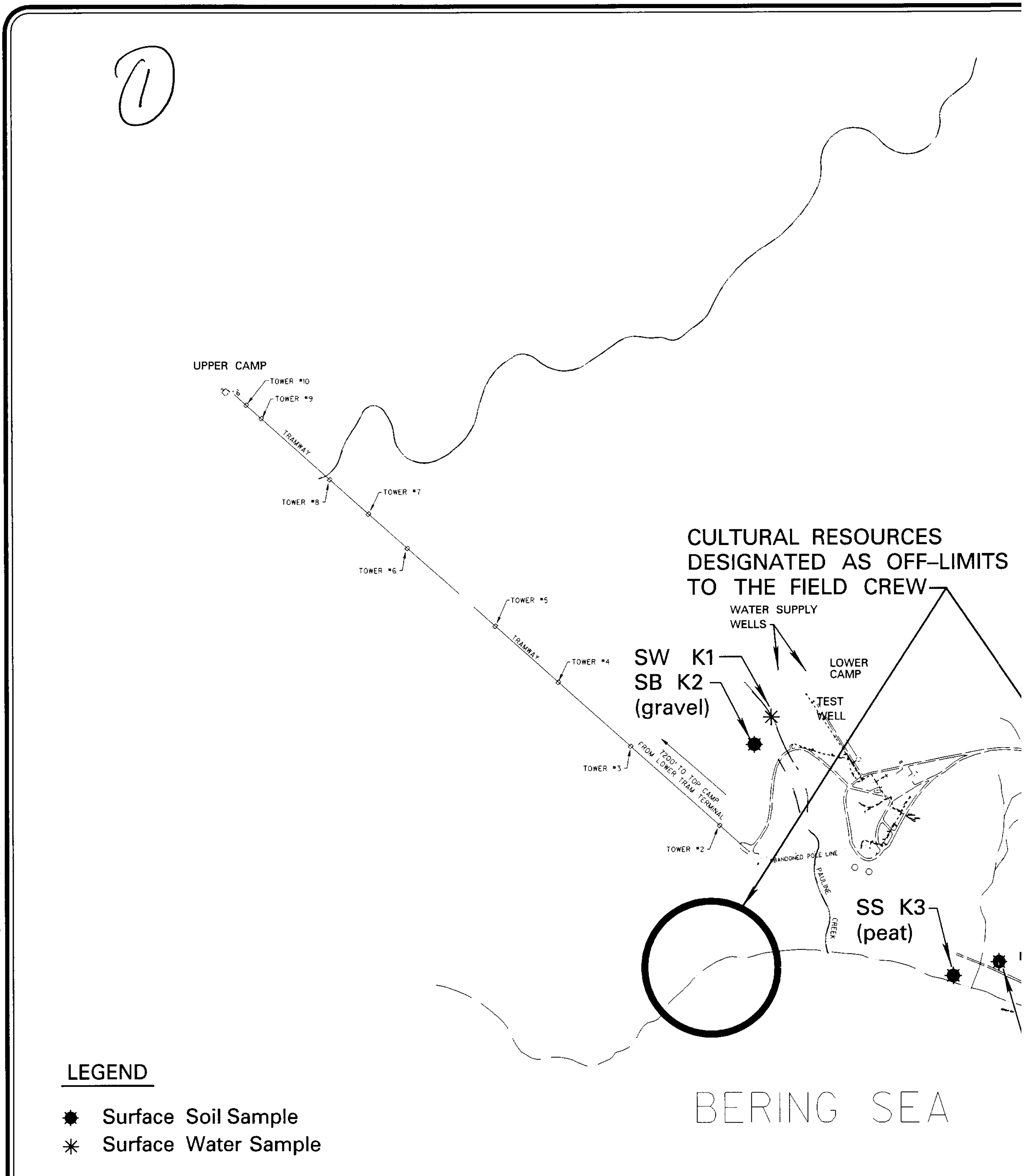


FIGURE 1–6

IN CITY LRRS, ALASKA

NO FURTHER RESPONSE ACTION PLANNED (NFRAP) IRP SITES



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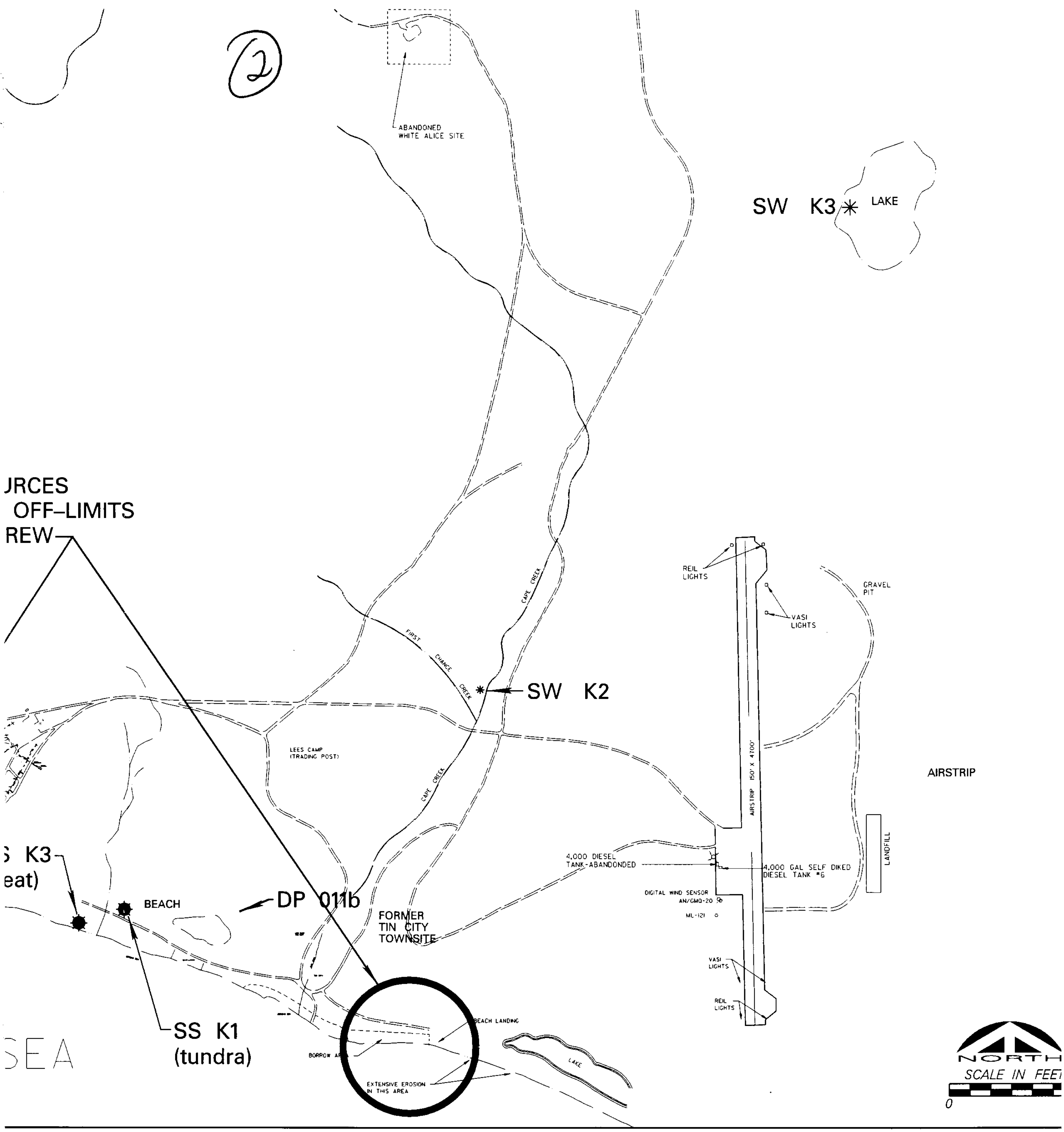


FIGURE 1–7

TIN CITY LRRS, ALASKA

CULTURAL RESOURCES

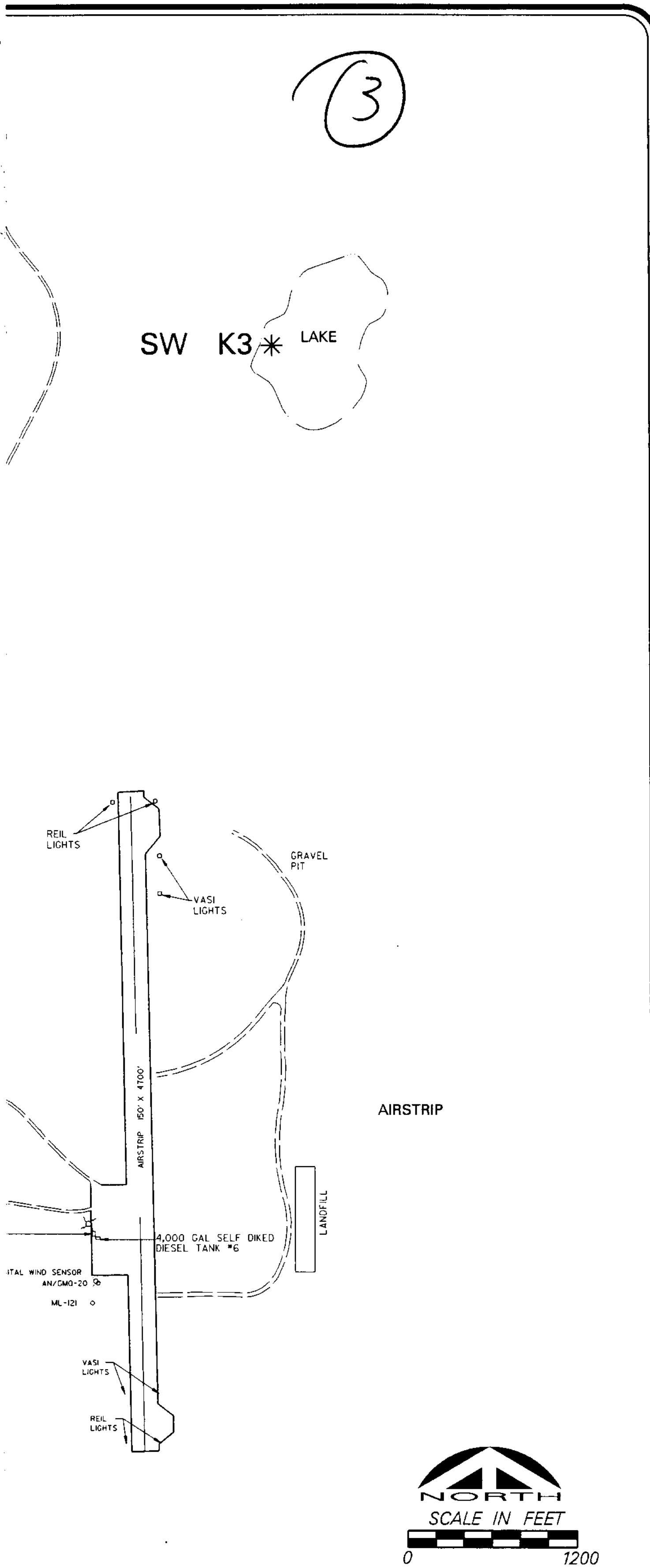
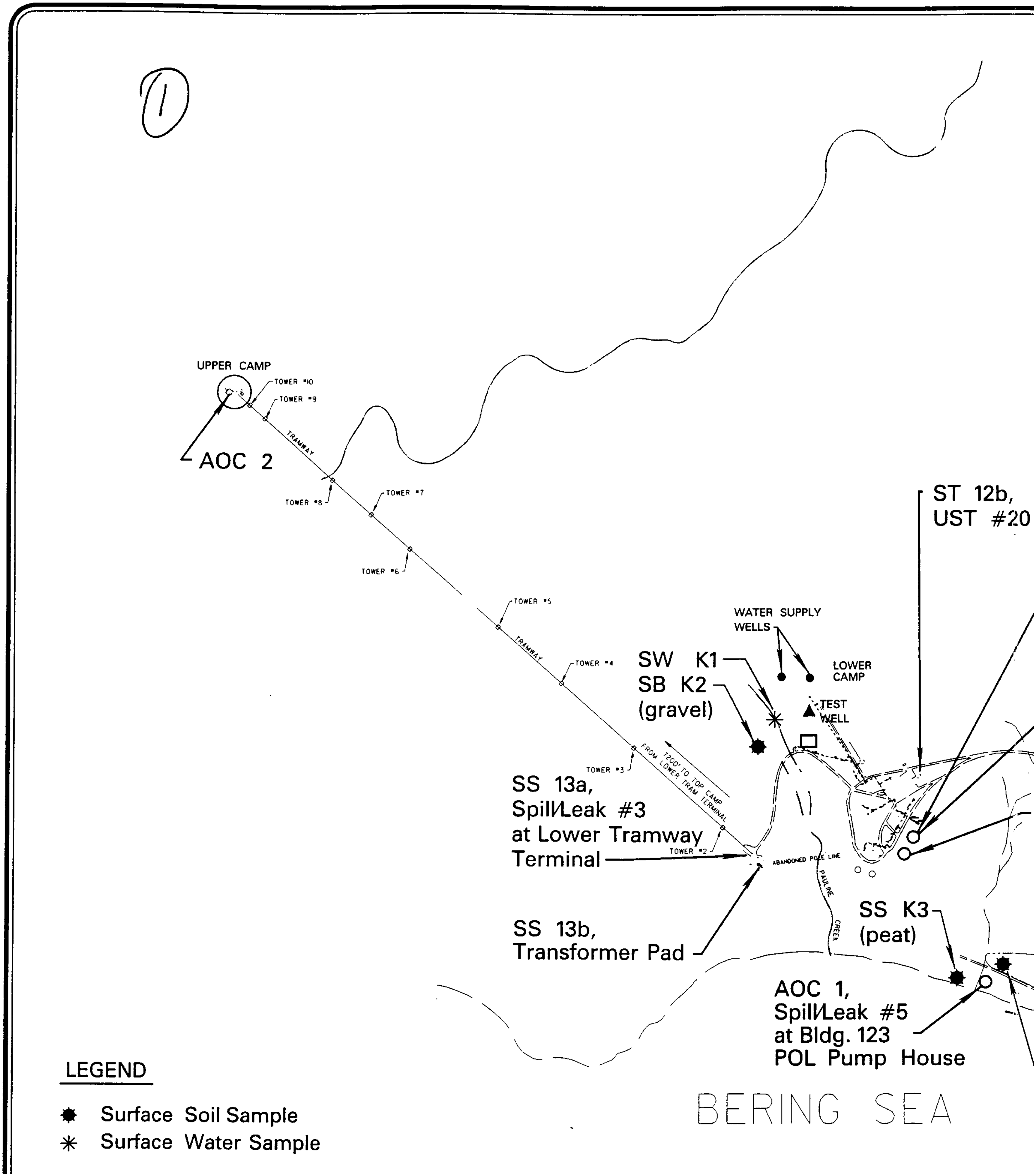


FIGURE 1-7

TIN CITY LRRS, ALASKA

CULTURAL RESOURCES



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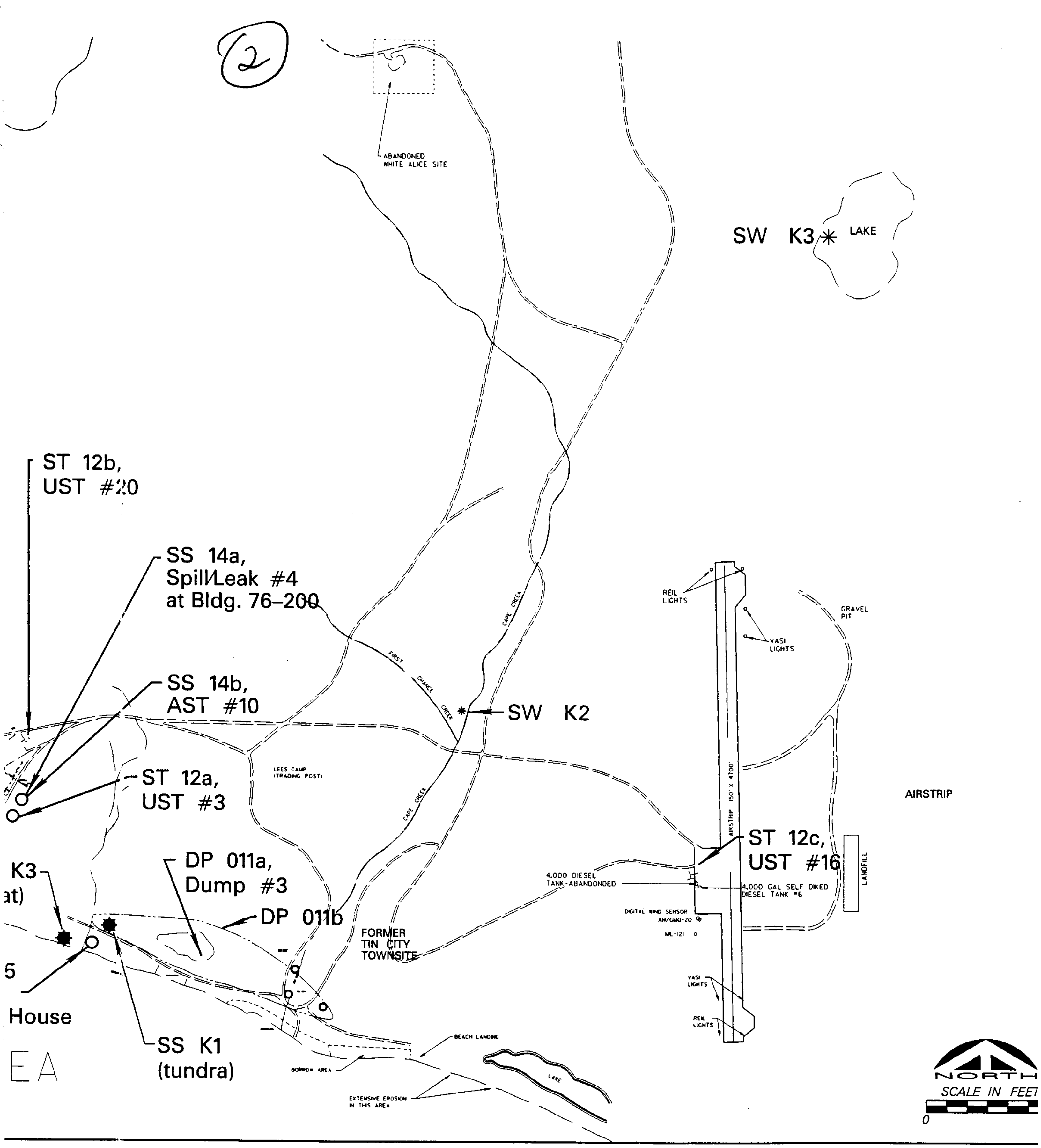
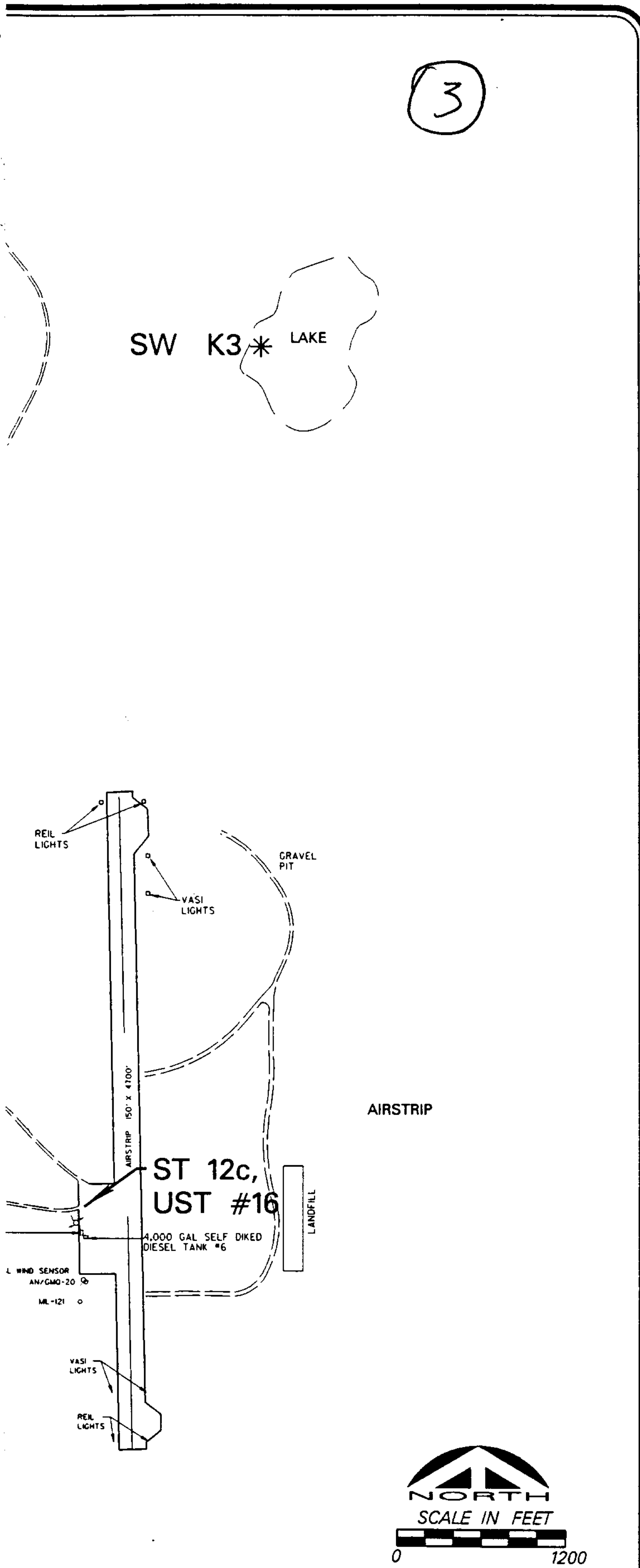


FIGURE 1–8

TIN CITY LRRS, ALASKA

IRP SOURCES AND AOC IDENTIFIE
FOR 1995 INVESTIGATION



GURE 1–8

N CITY LRRS, ALASKA

RP SOURCES AND AOC IDENTIFIED
'OR 1995 INVESTIGATION

DATE: ..28/9_
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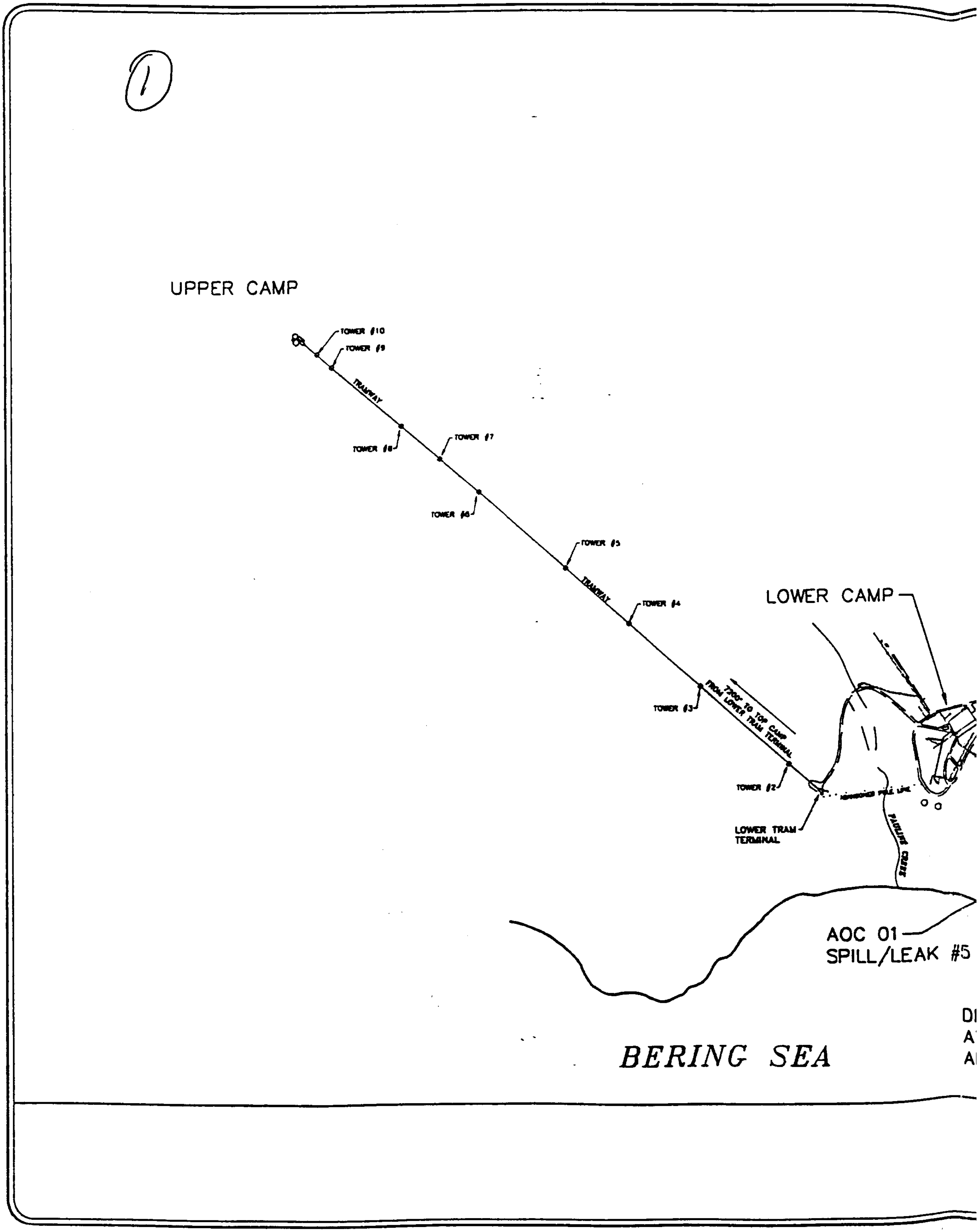
FILE: 95340201



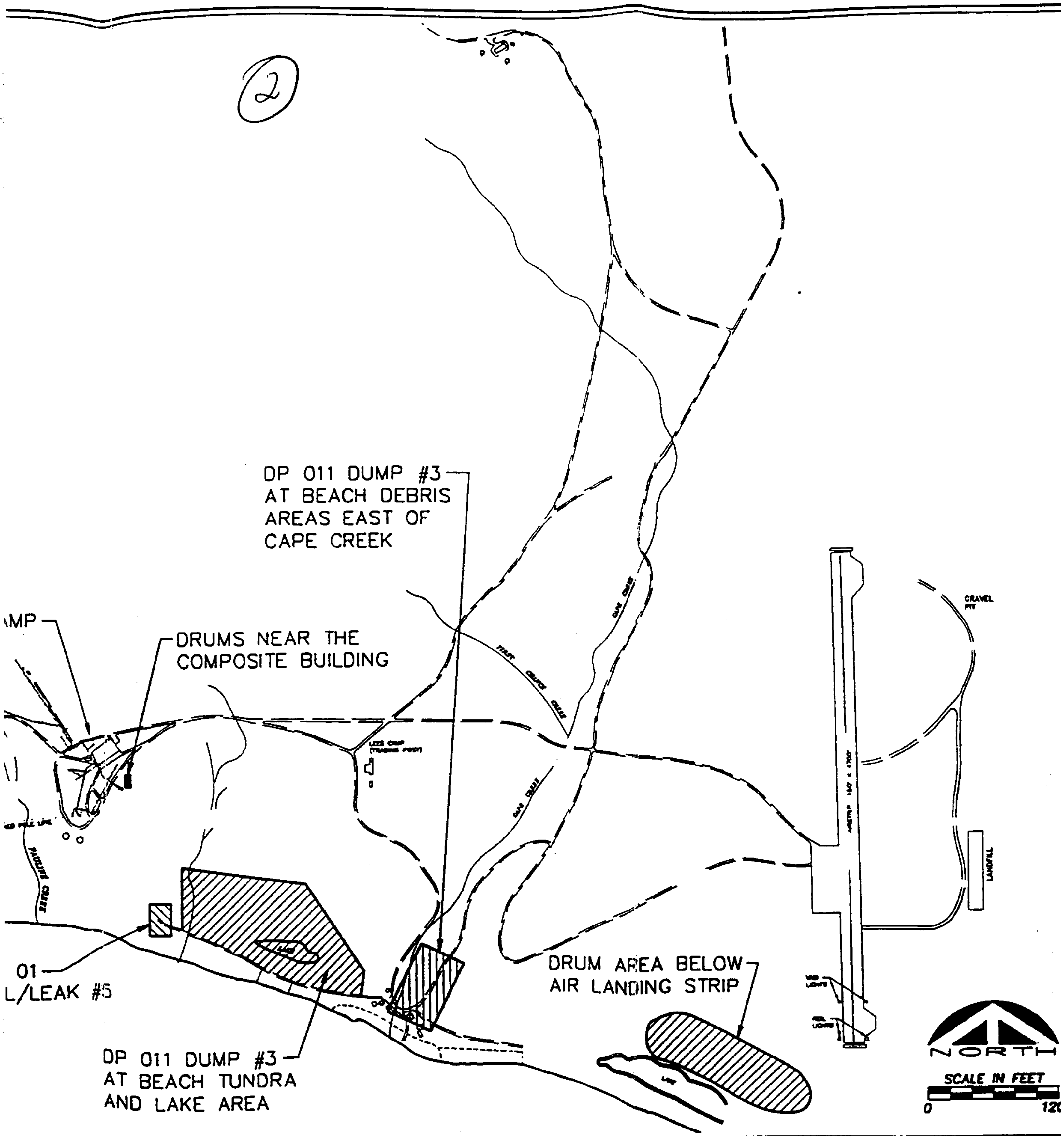
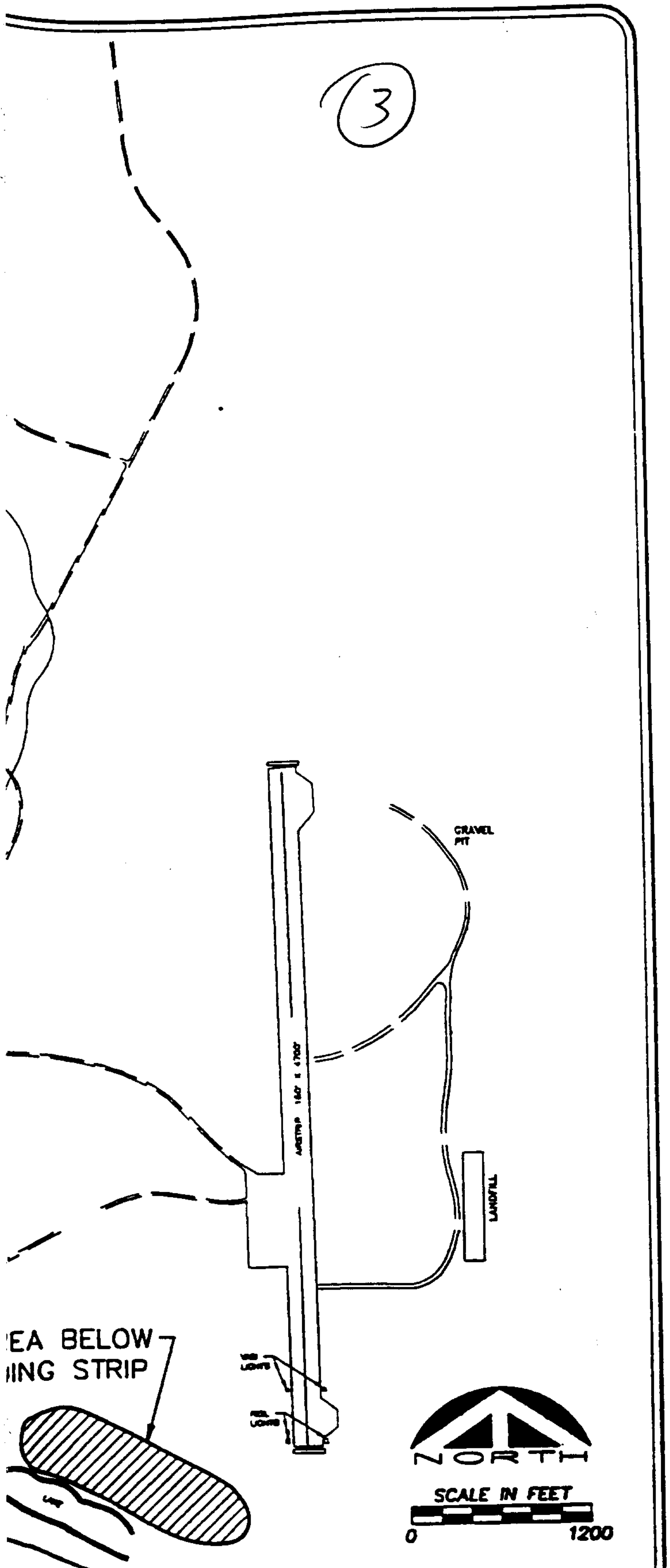
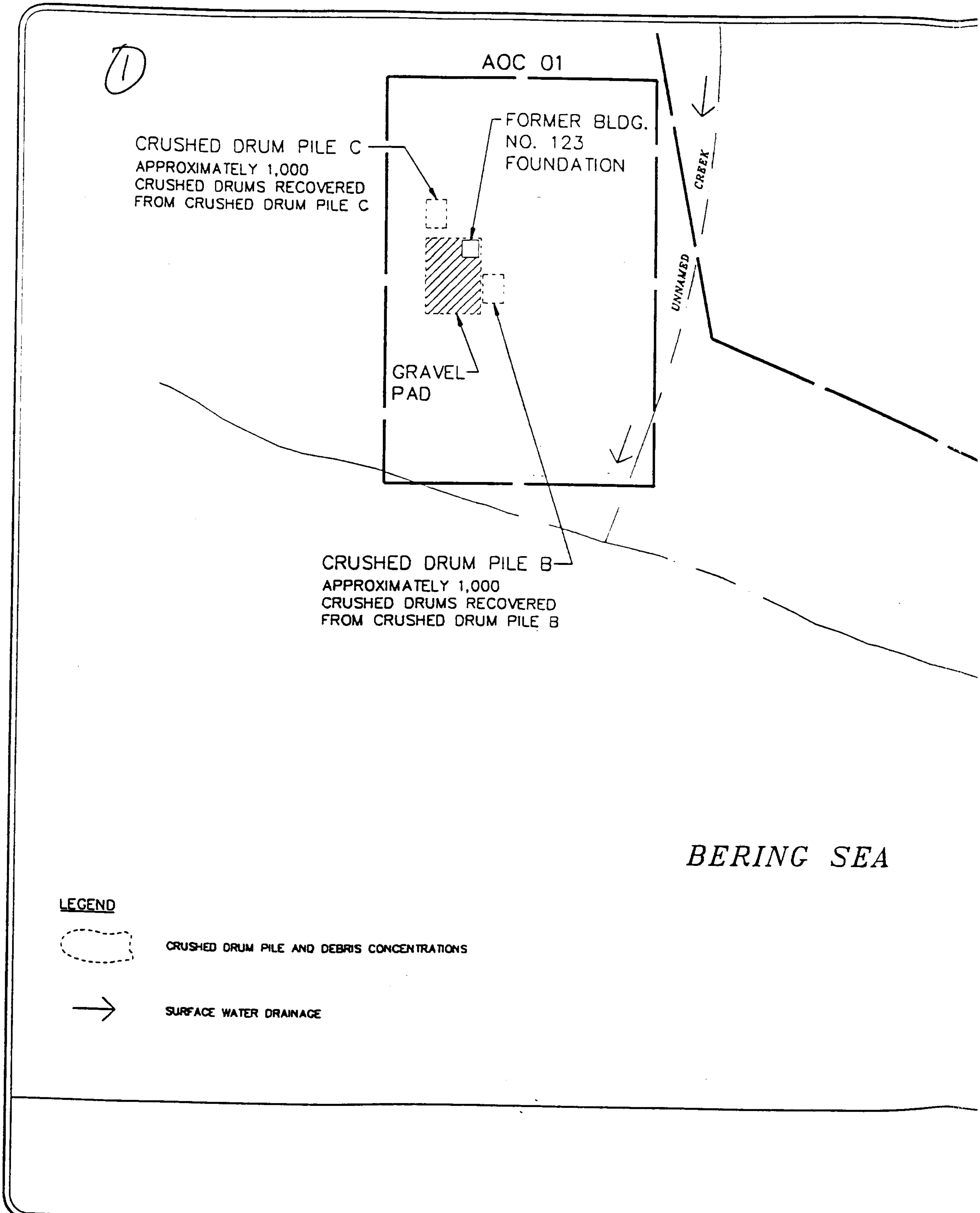


FIGURE 1-9
AFCEE
TIN CITY LRRS
TIN CITY LRRS SITE OVERVIEW



URE 1-9
EE
CITY LRRS
N CITY LRRS SITE OVERVIEW



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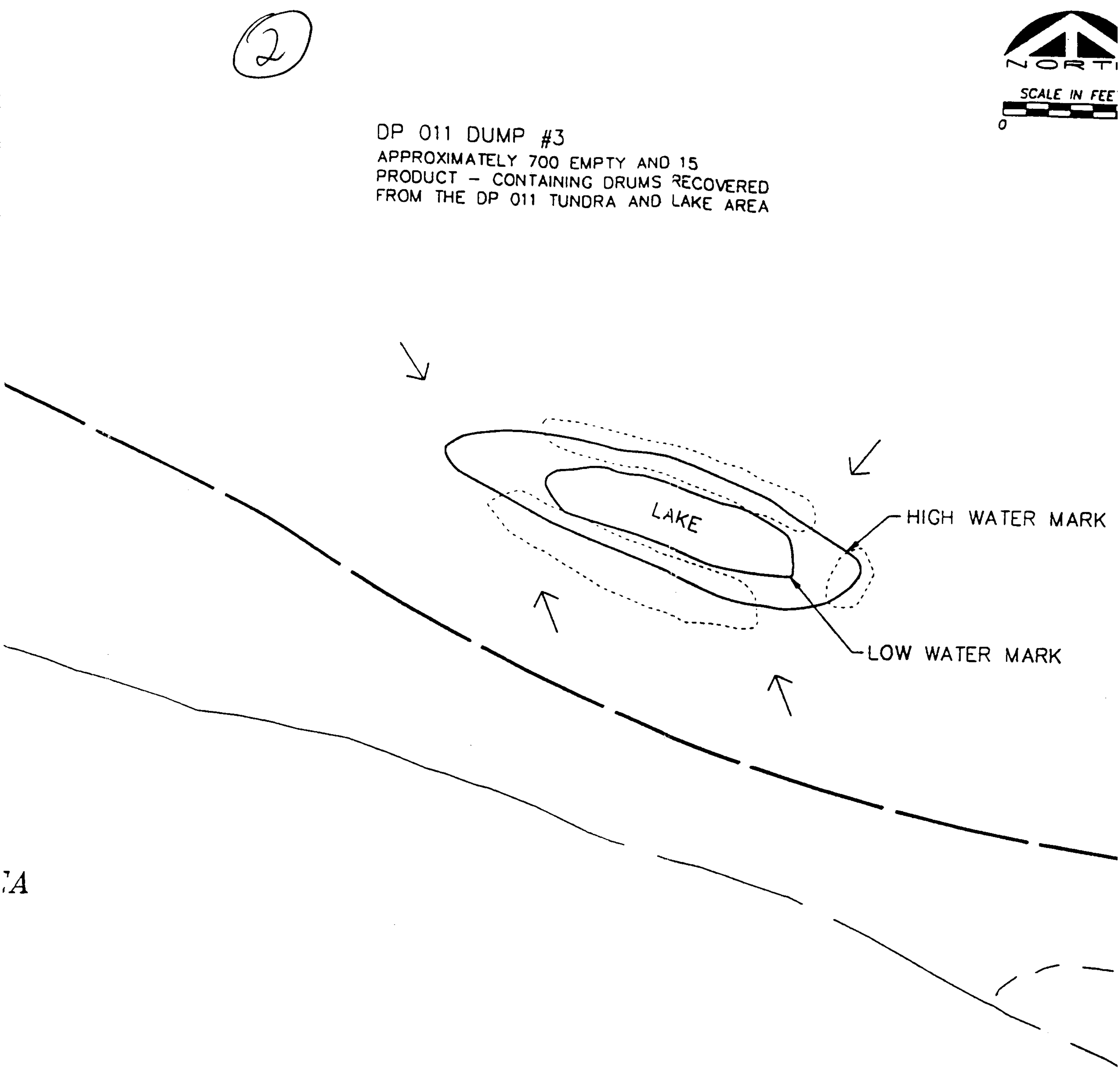
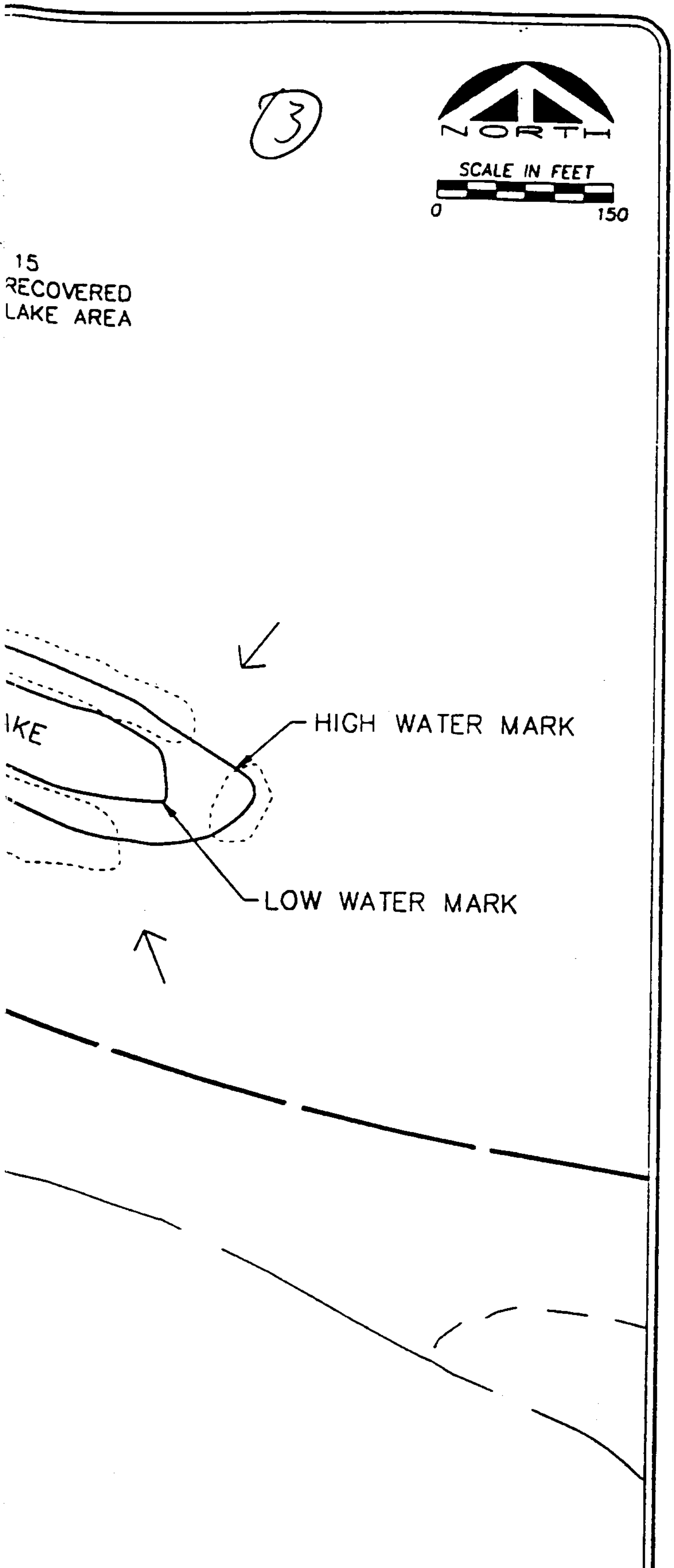


FIGURE 1-10
AFCEE
TIN CITY LRRS
DRUM CONCENTRATIONS AT DP 011 TUNDRA AND LAKE AREA AND AOC 01



URE 1-10
E
CITY LRRS
UM CONCENTRATIONS AT DP 011
NDRA AND LAKE AREA AND AOC 01

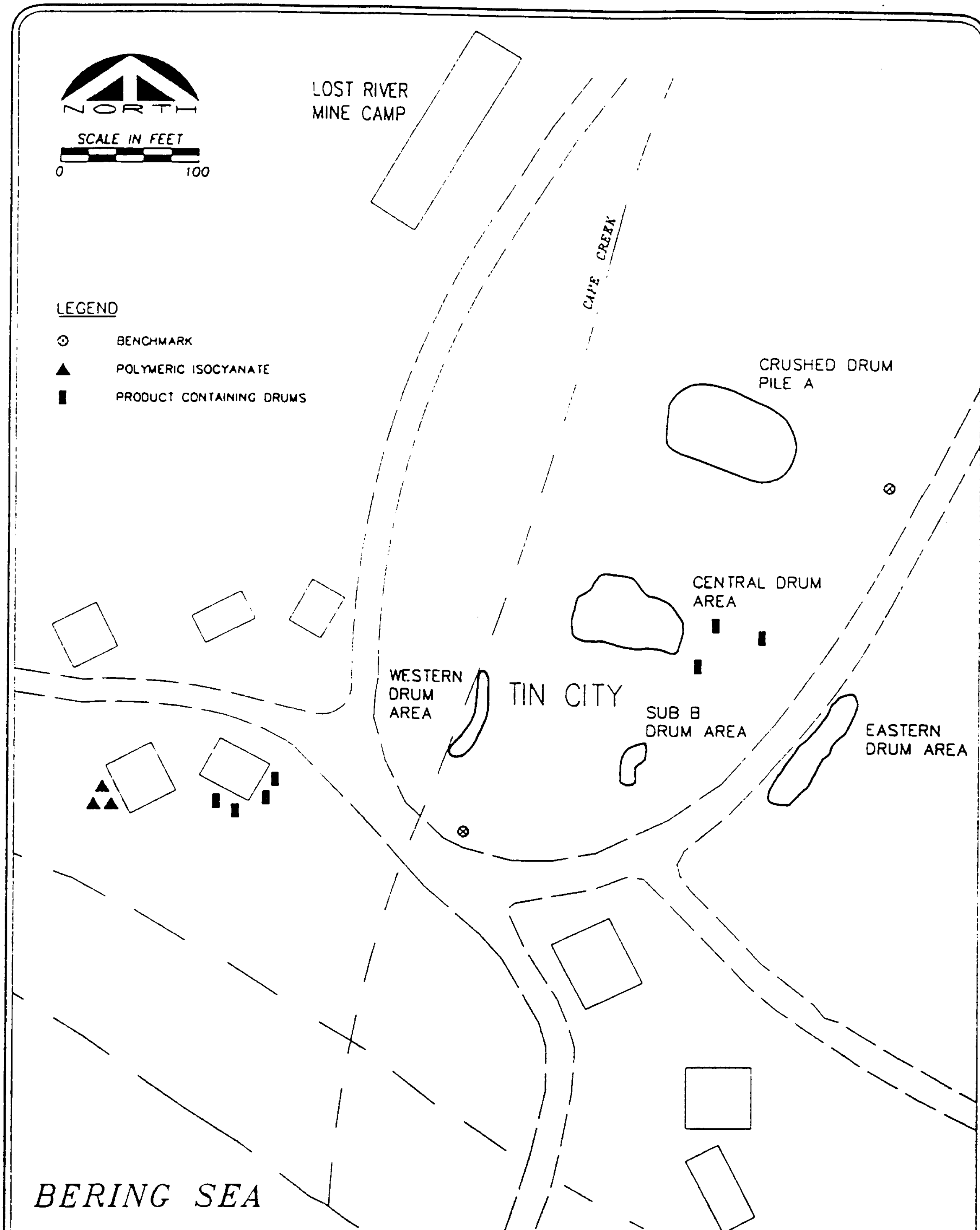


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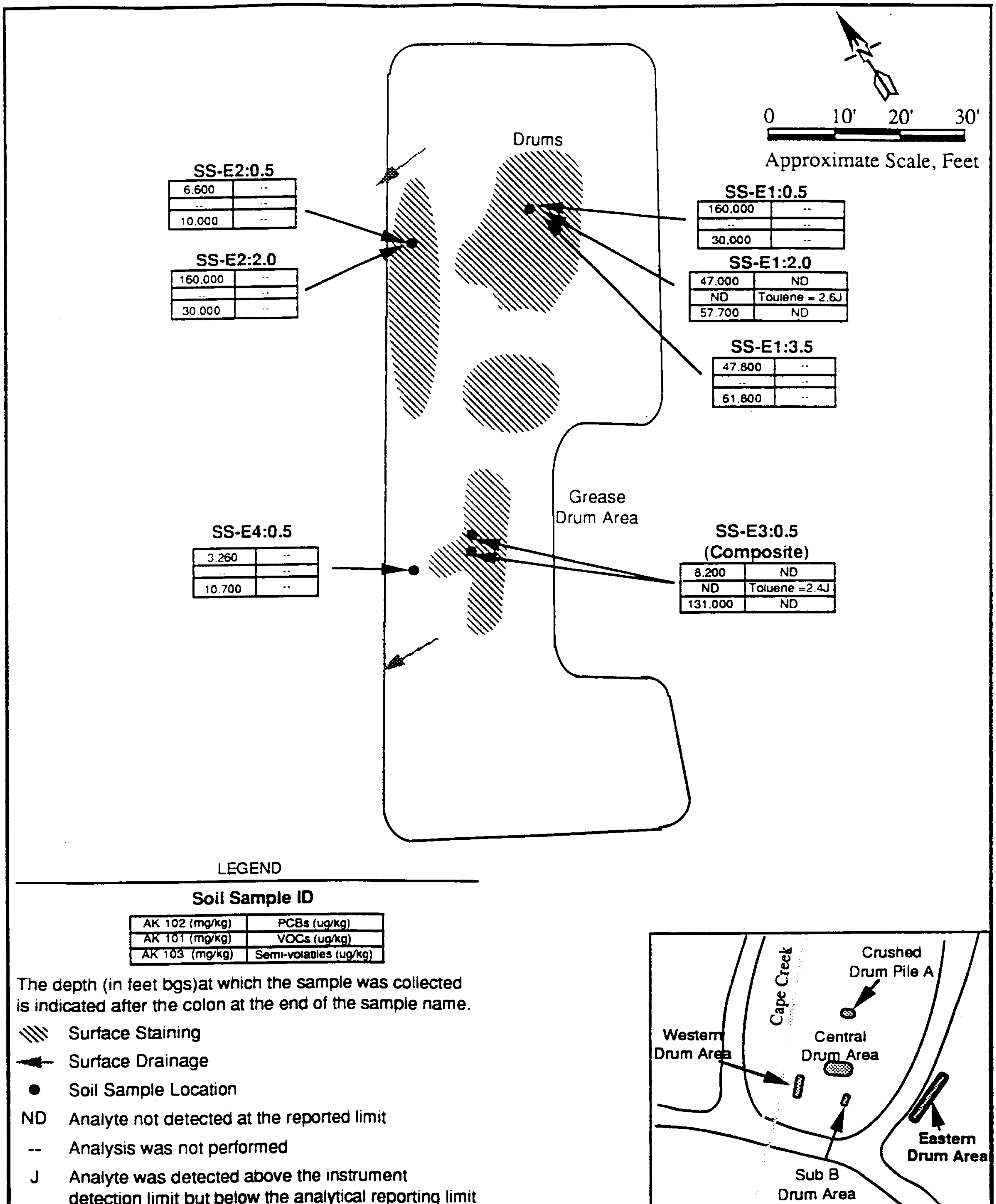
FIGURE 1-11

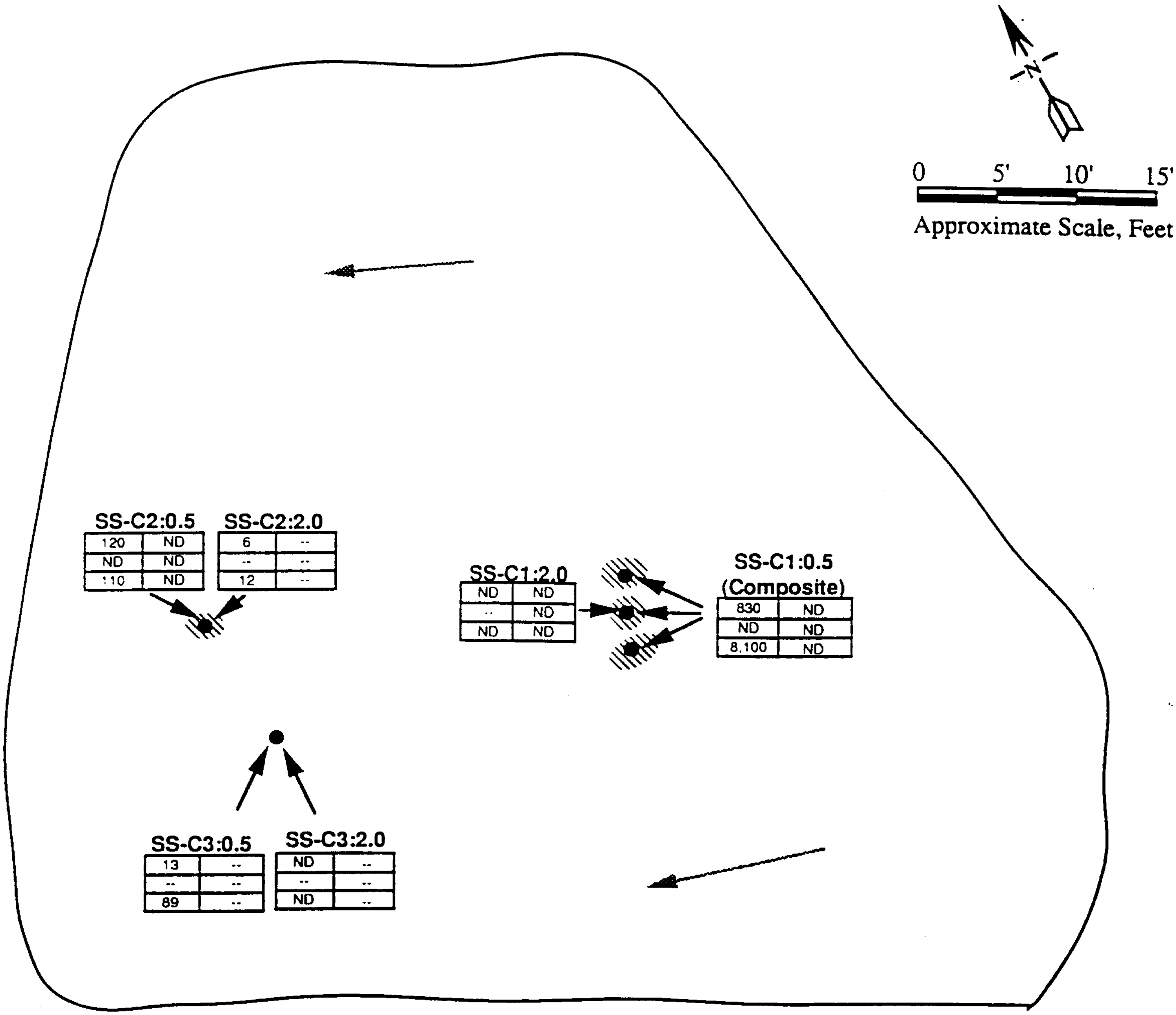
AFCEE

TIN CITY LRRS

DP 011 DRUM AREAS EAST OF CAPE CREEK



August 1995	SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS DP 011 - EASTERN DRUM AREA	Figure 1-12
Tin City LRRS, Alaska		



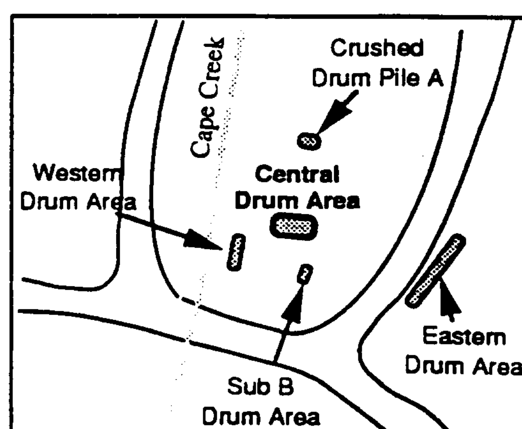
LEGEND

Soil Sample ID

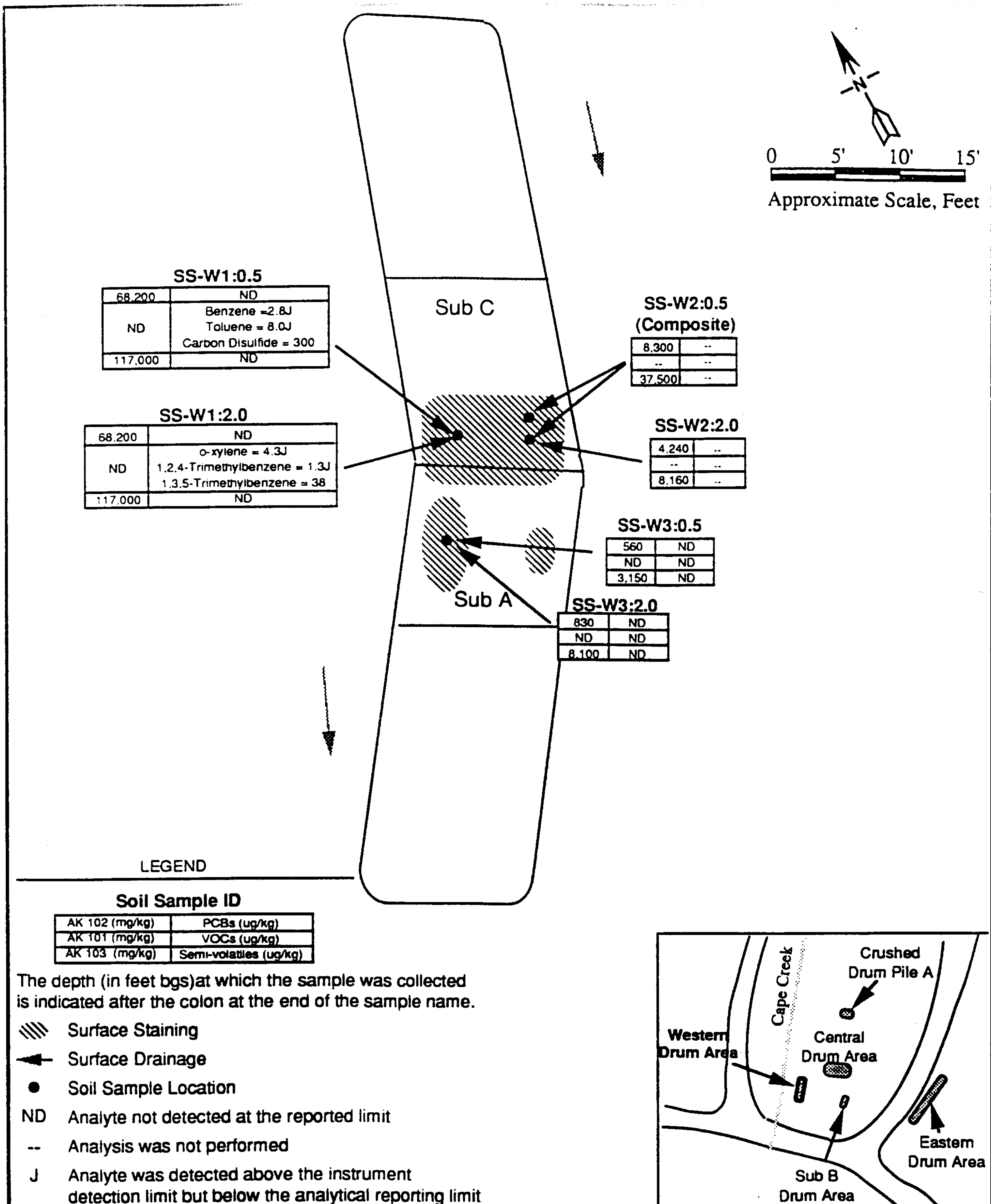
AK 102 (mg/kg)	PCBs (ug/kg)
AK 101 (mg/kg)	VOCs (ug/kg)
AK 103 (mg/kg)	Semi-volatiles (ug/kg)

The depth (in feet bgs)at which the sample was collected is indicated after the colon at the end of the sample name.

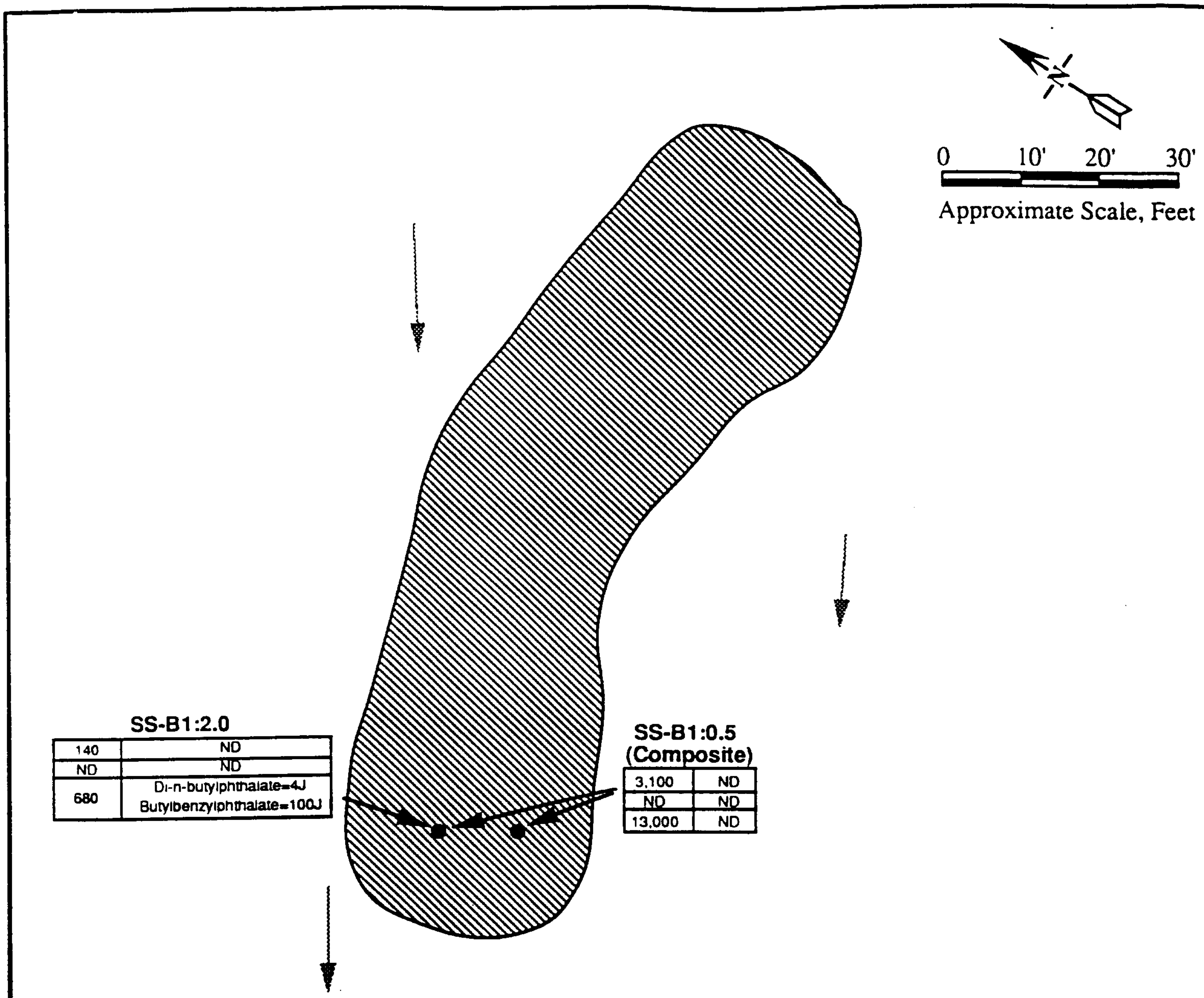
- Surface Staining
- Surface Drainage
- Soil Sample Location
- ND Analyte not detected at the reported limit
- -- Analysis was not performed
- J Analyte was detected above the instrument detection limit but below the analytical reporting limit



August 1995	SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS DP 011 - CENTRAL DRUM AREA	Figure 1–13
Tin City LRRS, Alaska		



August 1995	SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS DP 011 - WESTERN DRUM AREA	Figure 1–14
Tin City LRRS, Alaska		



SS-B1:2.0

140	ND
ND	ND
680	Di-n-butylphthalate=4J Butylbenzylphthalate=100J

SS-B1:0.5 (Composite)

3,100	ND
ND	ND
13,000	ND

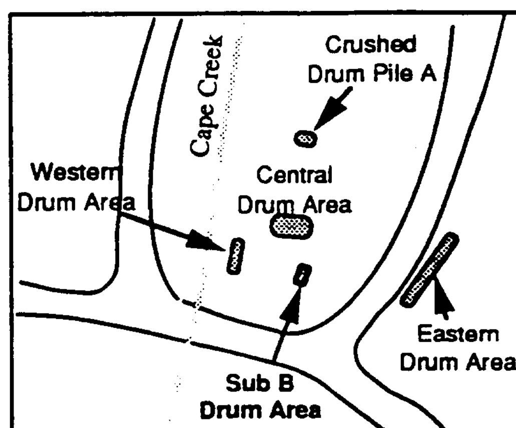
LEGEND

Soil Sample ID

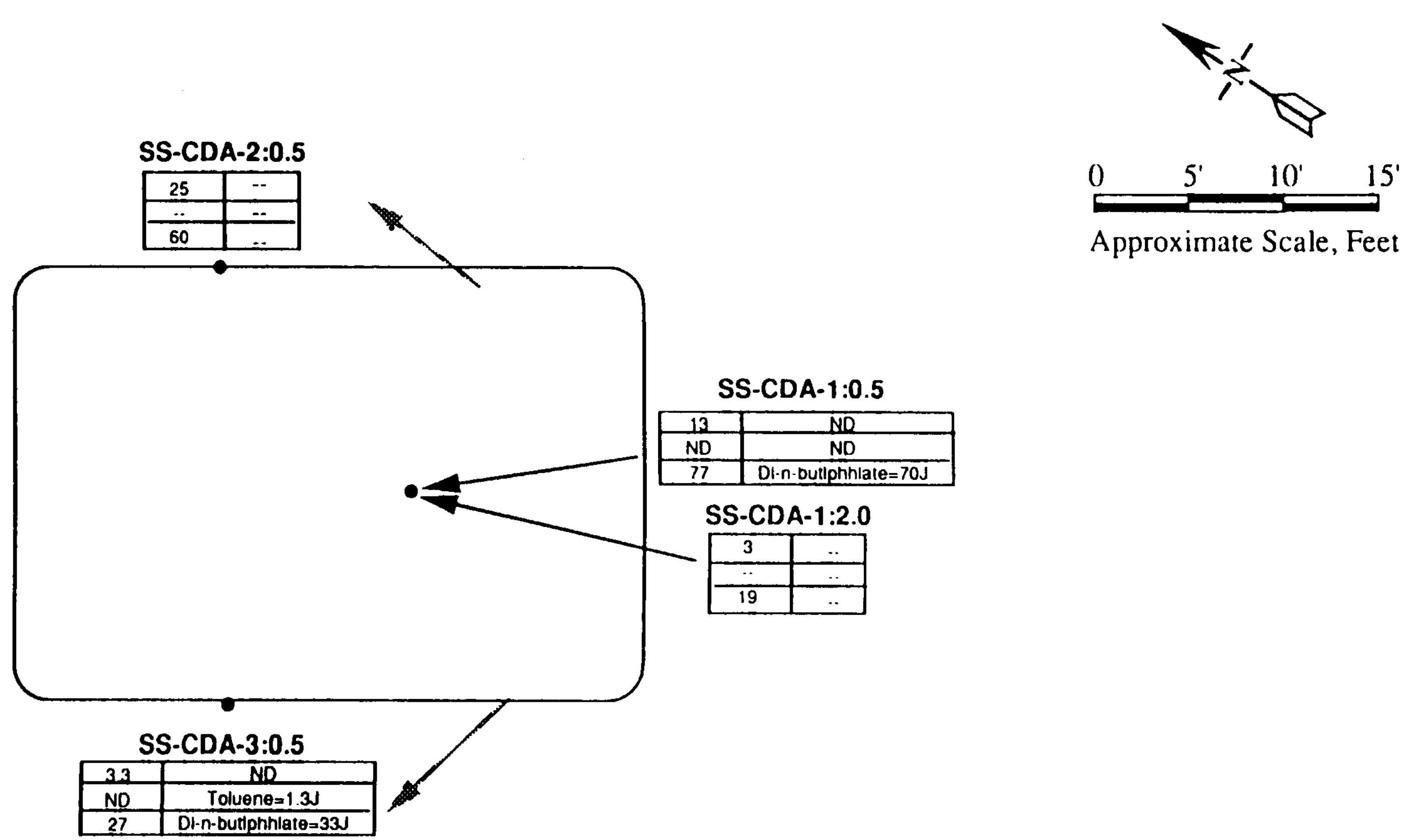
AK 102 (mg/kg)	PCBs (ug/kg)
AK 101 (mg/kg)	VOCs (ug/kg)
AK 103 (mg/kg)	Semi-volatiles (ug/kg)

The depth (in feet bgs)at which the sample was collected is indicated after the colon at the end of the sample name.

- Surface Staining
- Surface Drainage
- ● Soil Sample Location
- ND Analyte not detected at the reported limit
- -- Analysis was not performed
- J Analyte was detected above the instrument detection limit but below the analytical reporting limit



August 1995	SOIL SAMPLE LOCATIONS AND ANALAYTICAL RESULTS DP 011 - SUB B DRUM AREA	Figure 1–15
Tin City LRRS, Alaska		



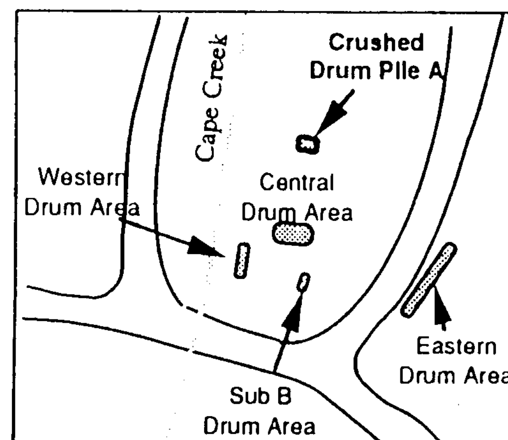
LEGEND

Soil Sample ID

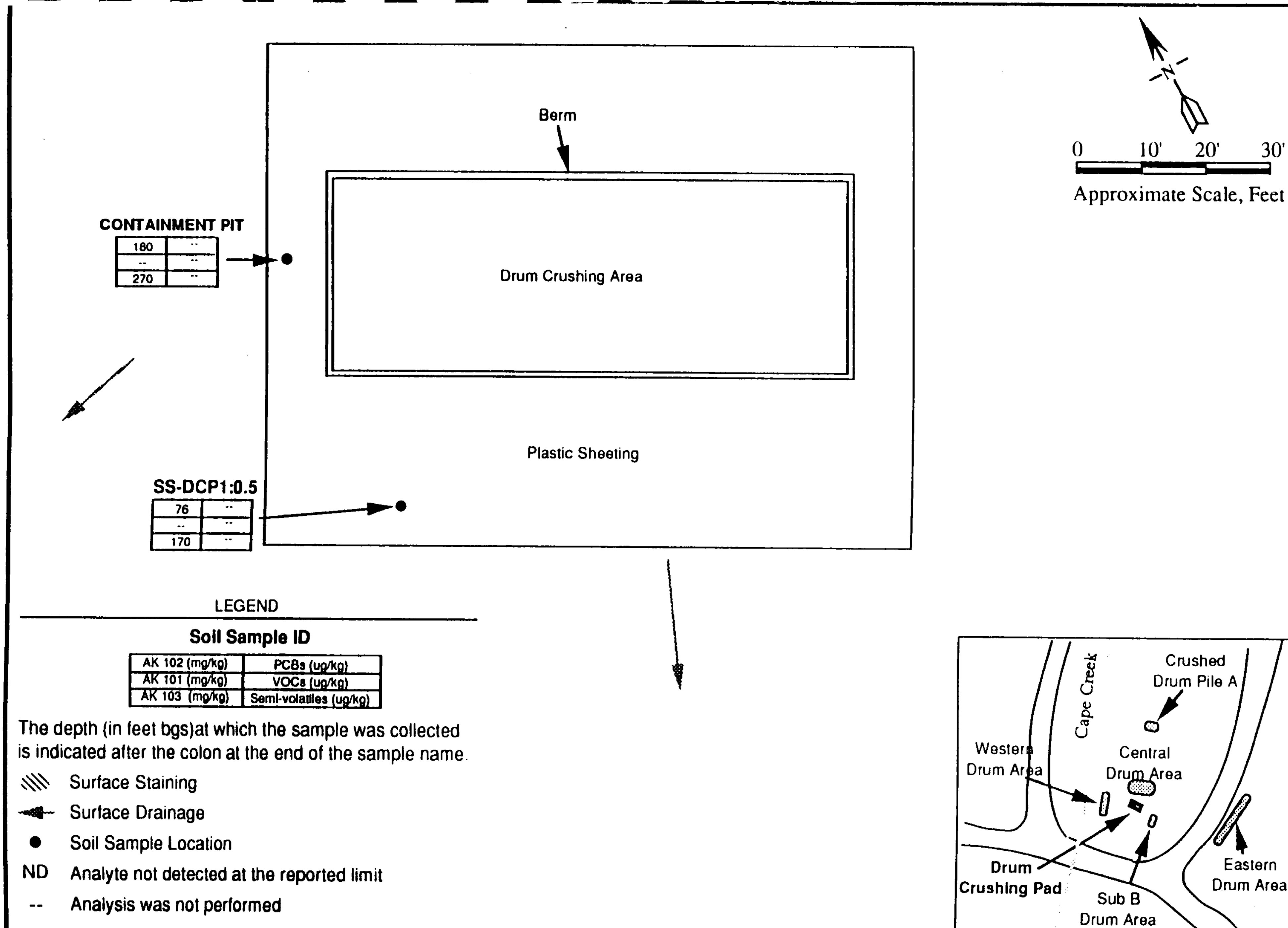
AK 102 (mg/kg)	PCBs (ug/kg)
AK 101 (mg/kg)	VOCs (ug/kg)
AK 103 (mg/kg)	Semi-volatiles (ug/kg)

The depth (in feet bgs)at which the sample was collected is indicated after the colon at the end of the sample name.

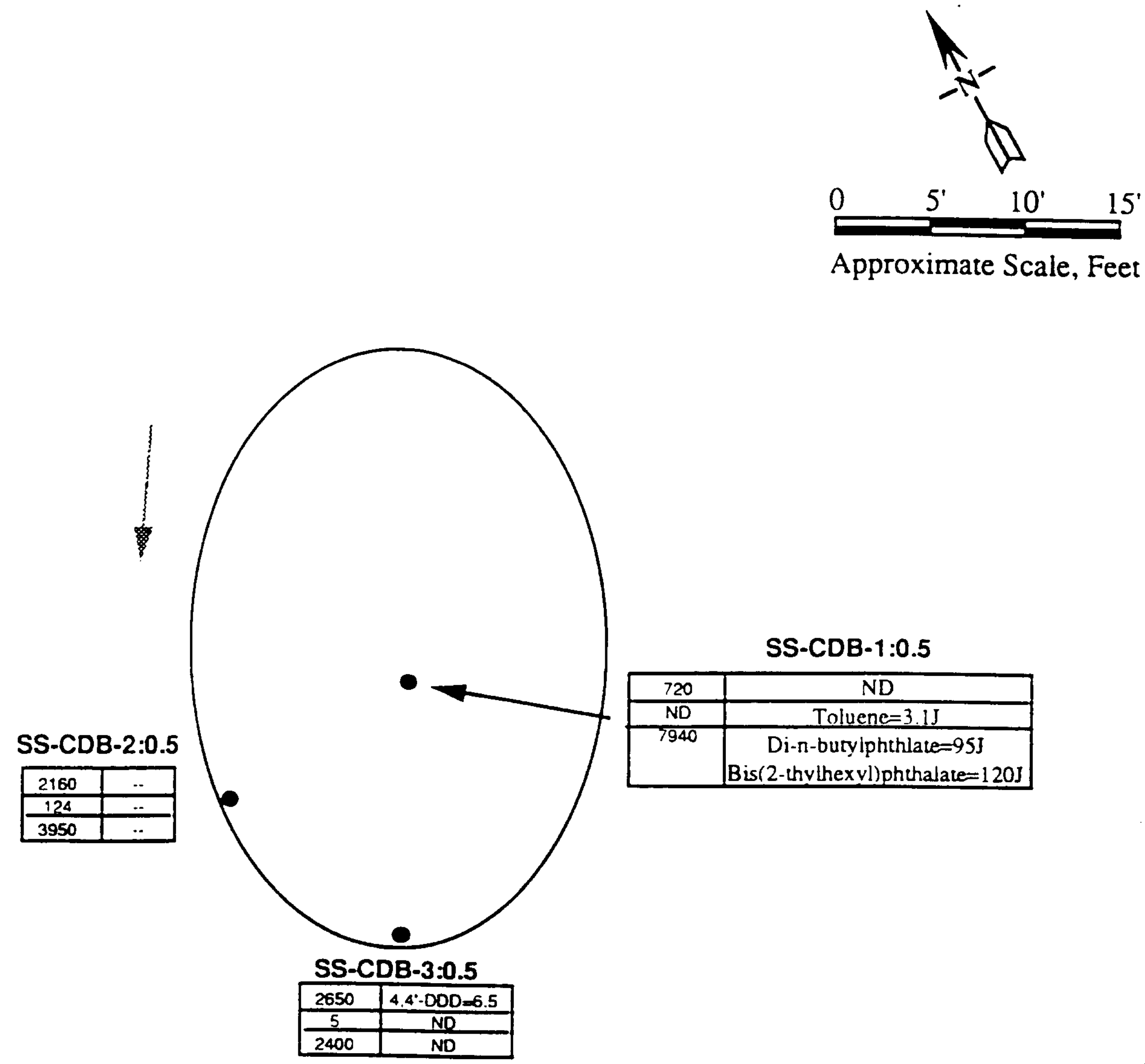
- Surface Staining
- Surface Drainage
- ● Soil Sample Location
- ND Analyte not detected at the reported limit
- -- Analysis was not performed
- J Analyte was detected above the instrument detection limit but below the analytical reporting limit



August 1995	SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS DP 011 - CRUSHED DRUM PILE A	Figure 1–16
Tin City LRRS, Alaska		



August 1995 Tin City LRRS, Alaska	SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS DRUM CRUSHING PAD	Figure 1–17



SS-CDB-1:0.5

720	ND
ND	Toluene=3.1J
7940	Di-n-butylphthlate=95J Bis(2-thylhexyl)phthalate=120J

SS-CDB-2:0.5

2160	--
124	--
3950	--

SS-CDB-3:0.5

2650	4,4'-DDD=6.5
5	ND
2400	ND

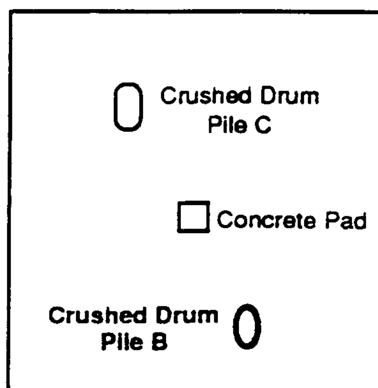
LEGEND

Soil Sample ID

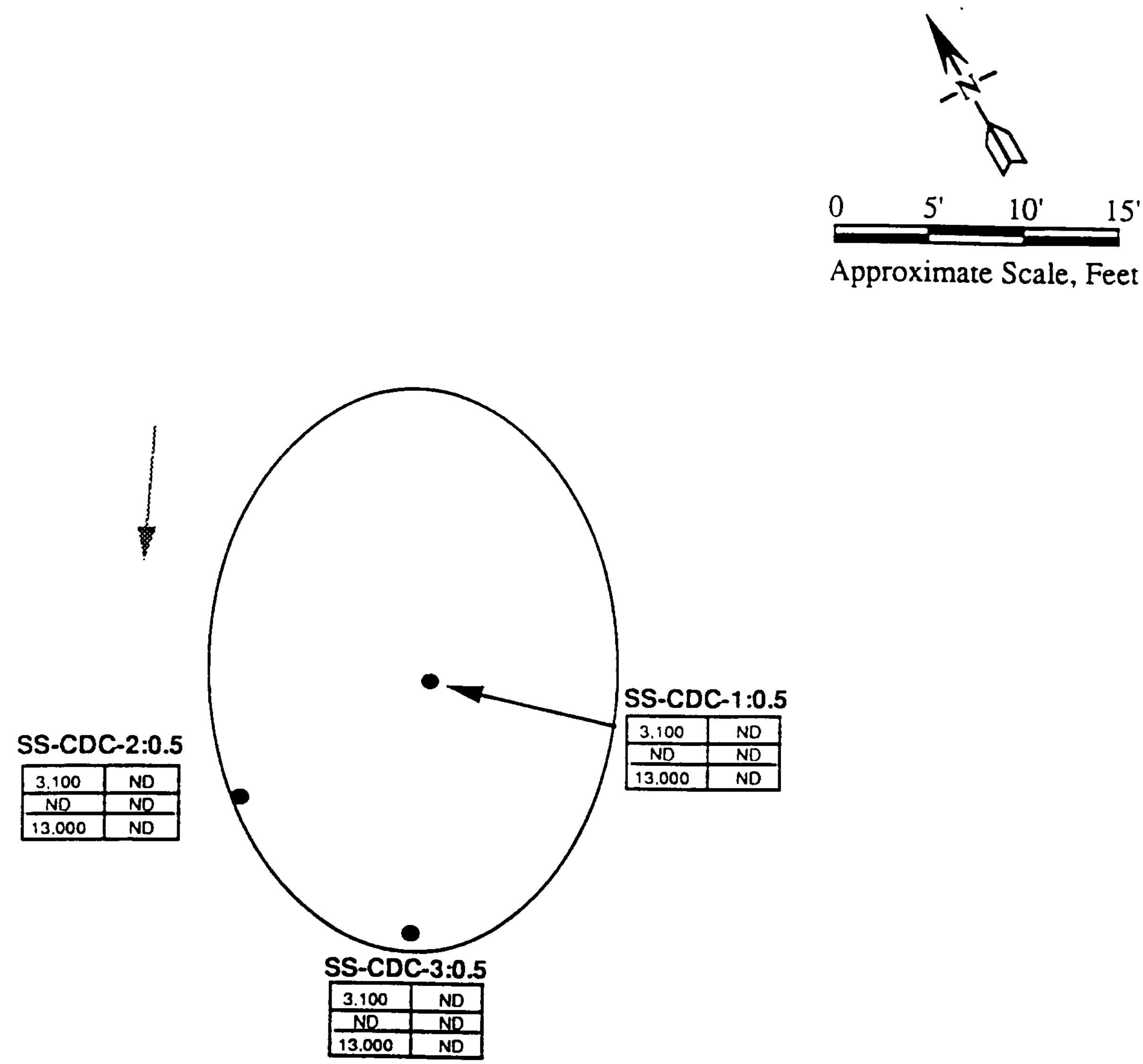
AK 102 (mg/kg)	PCBs (ug/kg)
AK 101 (mg/kg)	VOCs (ug/kg)
AK 103 (mg/kg)	Semi-volatiles (ug/kg)

The depth (in feet bgs)at which the sample was collected is indicated after the colon at the end of the sample name.

- Surface Staining
- Surface Drainage
- Soil Sample Location
- ND Analyte not detected at the reported limit
- -- Analysis was not performed
- J Analyte was detected above the instrument detection limit but below the analytical reporting limit



August 1995	SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS AOC 01 - CRUSHED DRUM PILE B	Figure 1–18
Tin City LRRS, Alaska		



LEGEND

Soil Sample ID

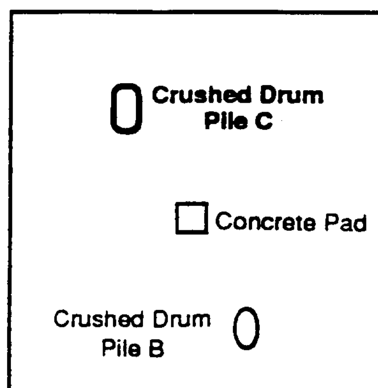
AK 102 (mg/kg)	PCBs (ug/kg)
AK 101 (mg/kg)	VOCs (ug/kg)
AK 103 (mg/kg)	Semi-volatiles (ug/kg)

The depth (in feet bgs)at which the sample was collected is indicated after the colon at the end of the sample name.

- Surface Staining
- Surface Drainage
- Soil Sample Location

ND Analyte not detected at the reported limit

-- Analysis was not performed



August 1995	SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS AOC 01 - CRUSHED DRUM PILE C	Figure 1–19
Tin City LRRS, Alaska		

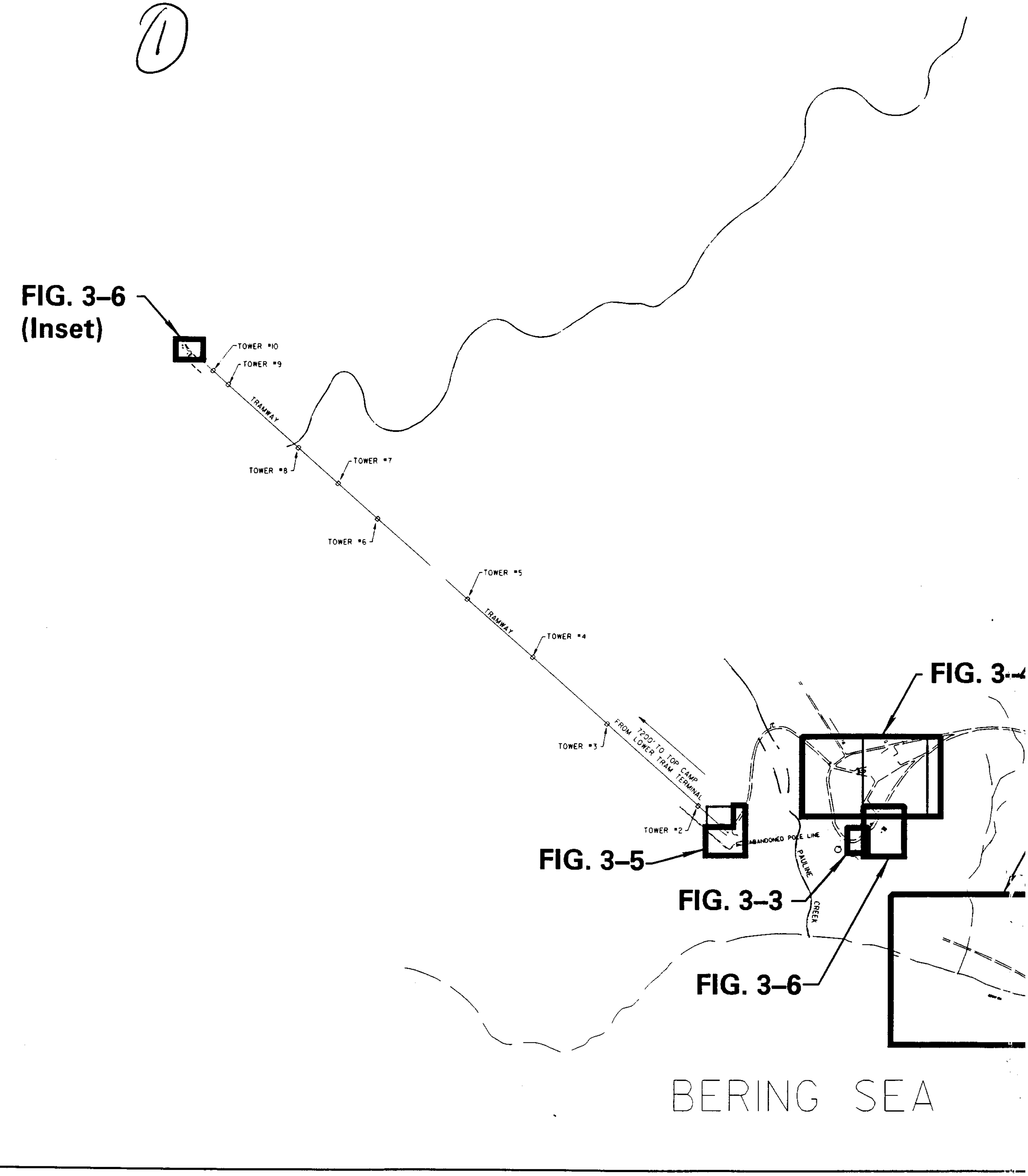
JOB No. 1811.0000

FIGURE 1-20

TIN CITY LRRS, ALASKA

AERIAL PHOTOGRAPH OF TIN CITY LRRS

1



JOB No. 3380.0020 TIME: 01-MAY-1996 10:31 FILE: c:\tlncity\fnlrpt\fg2.Ldgn

2

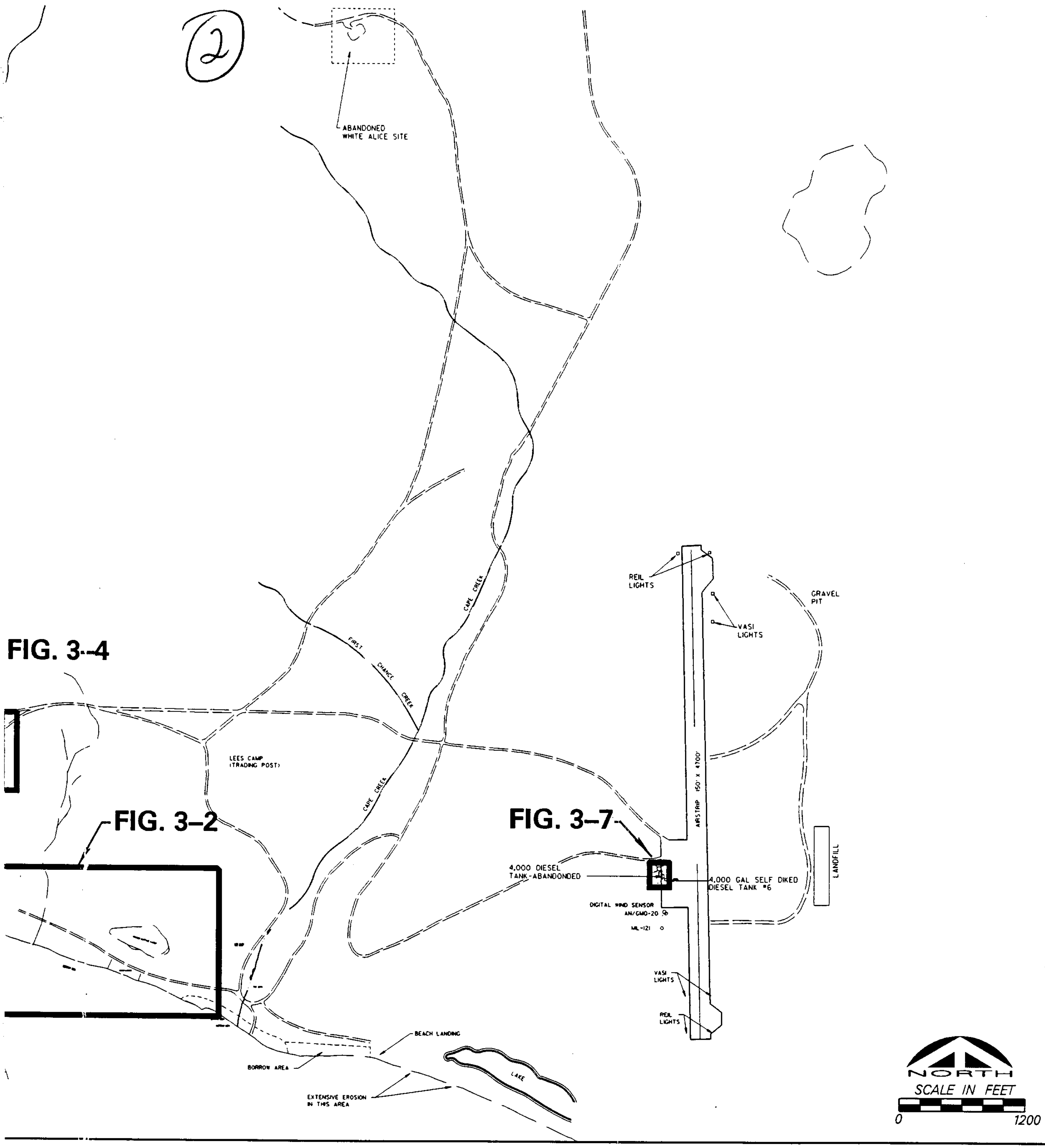
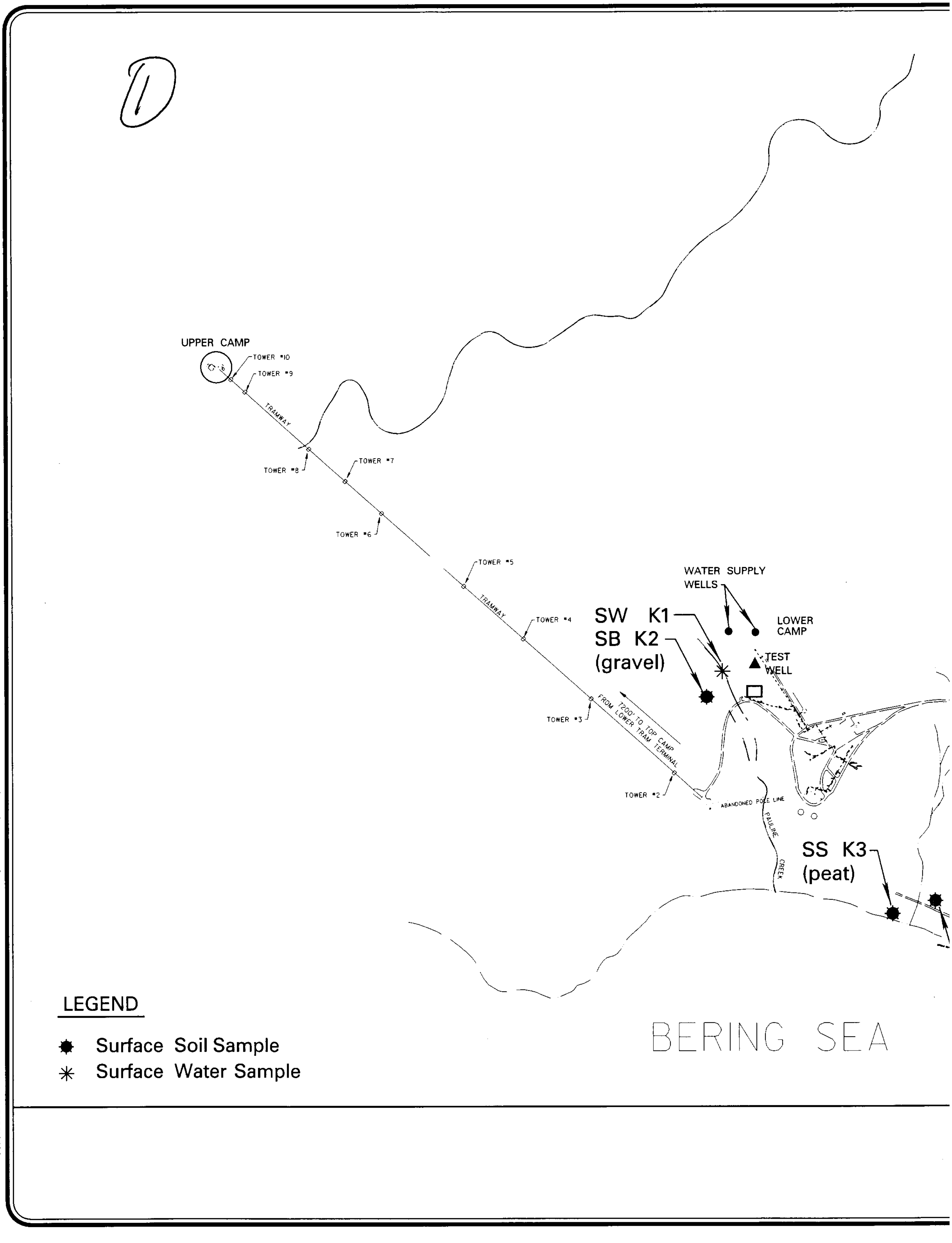


FIGURE 2-1

TIN CITY LRRS, ALASKA

KEY TO MAPS

JOB No. 3380.0020 TIME: 01-MAY-1996 10:32 FILE: c:\tincity\fnlrpt\fg3_l.dgn



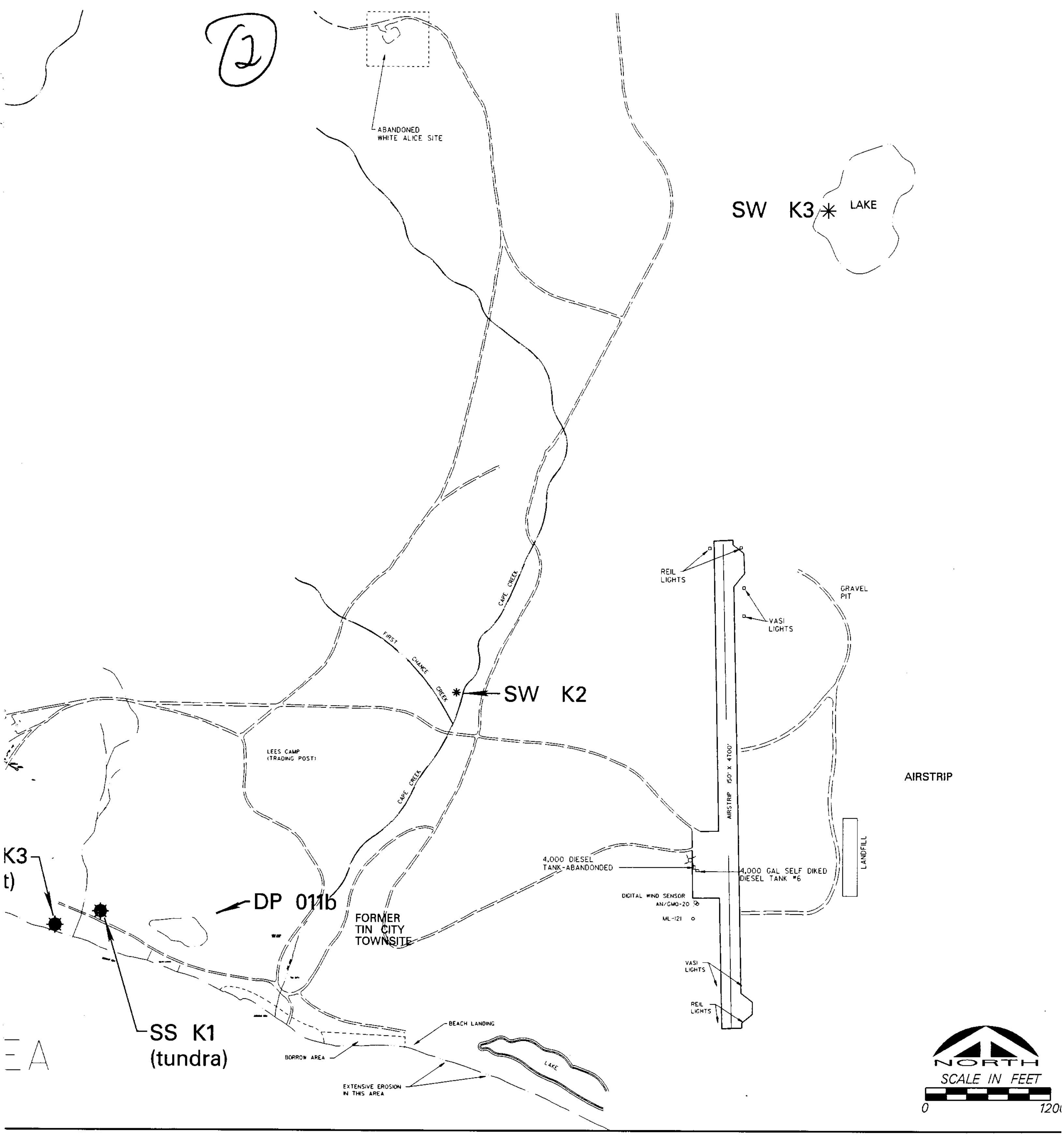


FIGURE 3-1

TIN CITY LRRS, ALASKA

BACKGROUND SAMPLE LOCATIONS

3

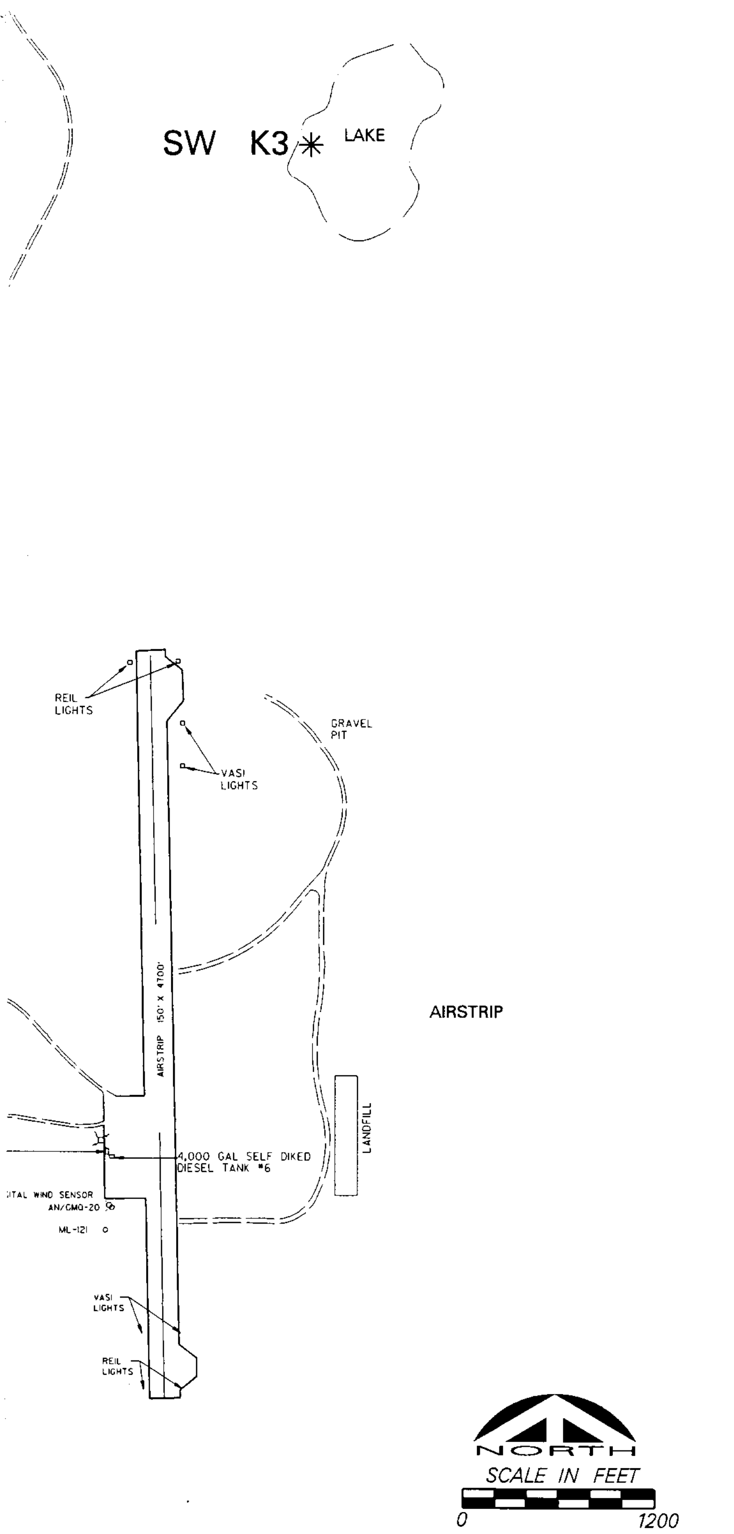
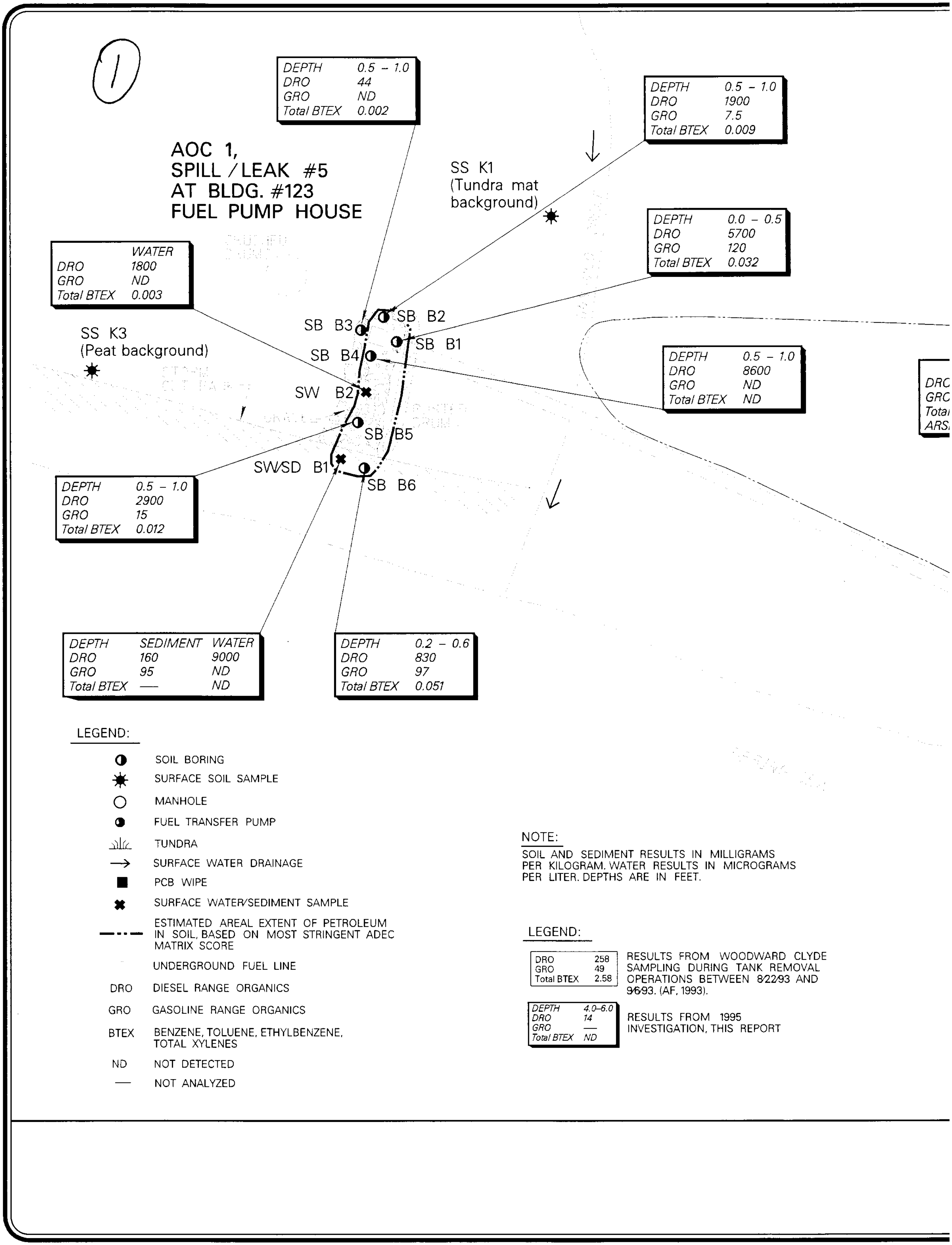


FIGURE 3-1

TIN CITY LRRS, ALASKA

BACKGROUND SAMPLE LOCATIONS



JOB No. 3380.0020 TIME: 01-MAY-1996 10:33 FILE: c:\tinclty\fnlrpt\fg3.2.dgn

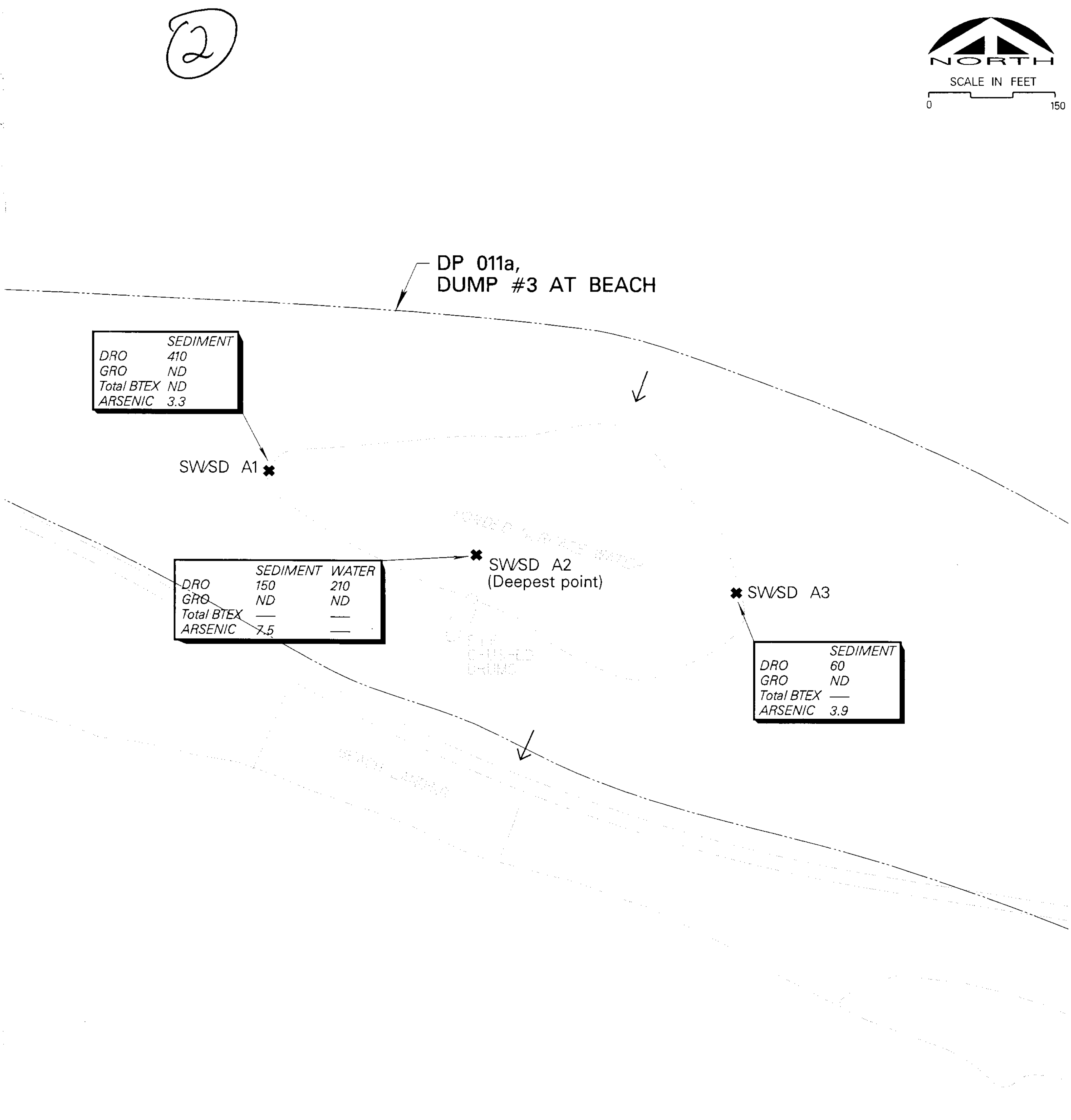


FIGURE 3–2

TIN CITY LRRS, ALASKA

BEACH SAMPLING LOCATIONS
DP 011a & AOC 1

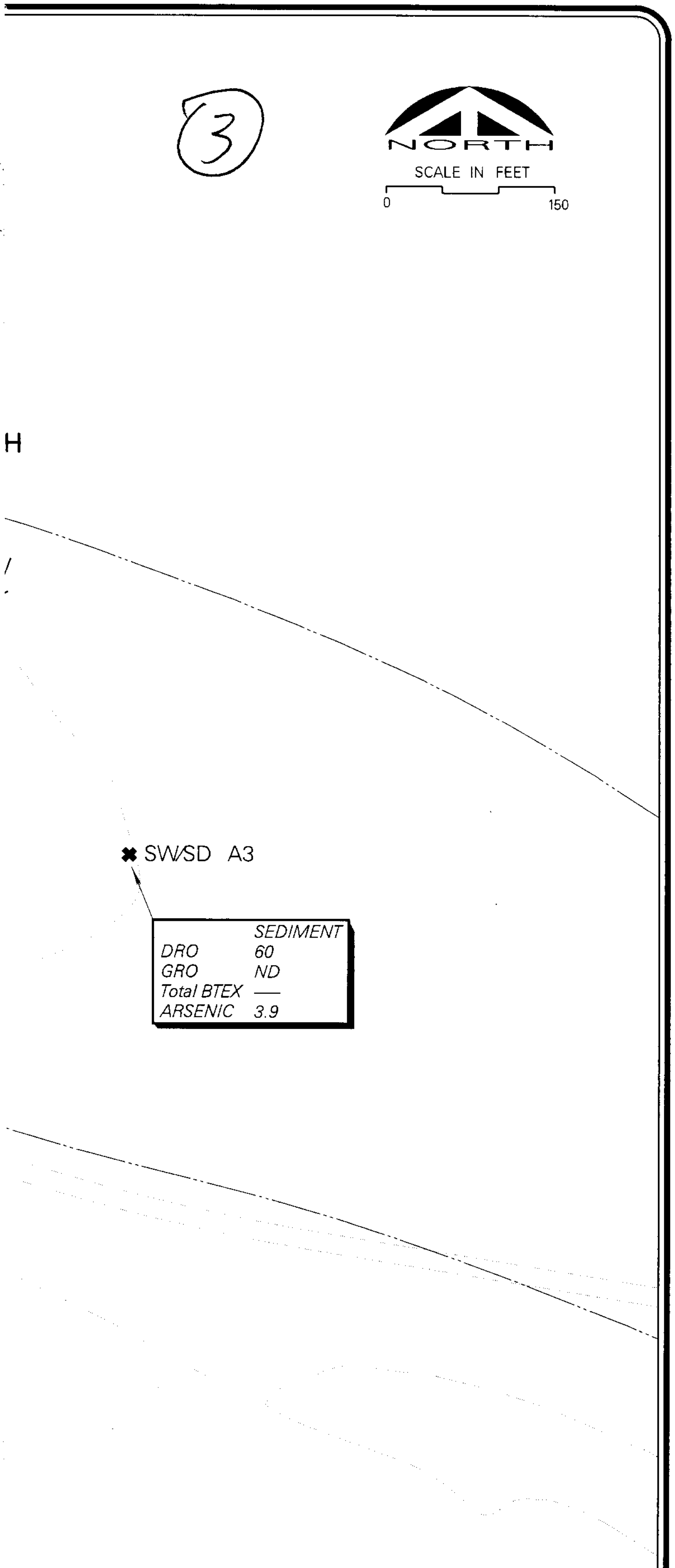


FIGURE 3–2

TIN CITY LRRS, ALASKA

BEACH SAMPLING LOCATIONS
DP 011a & AOC 1

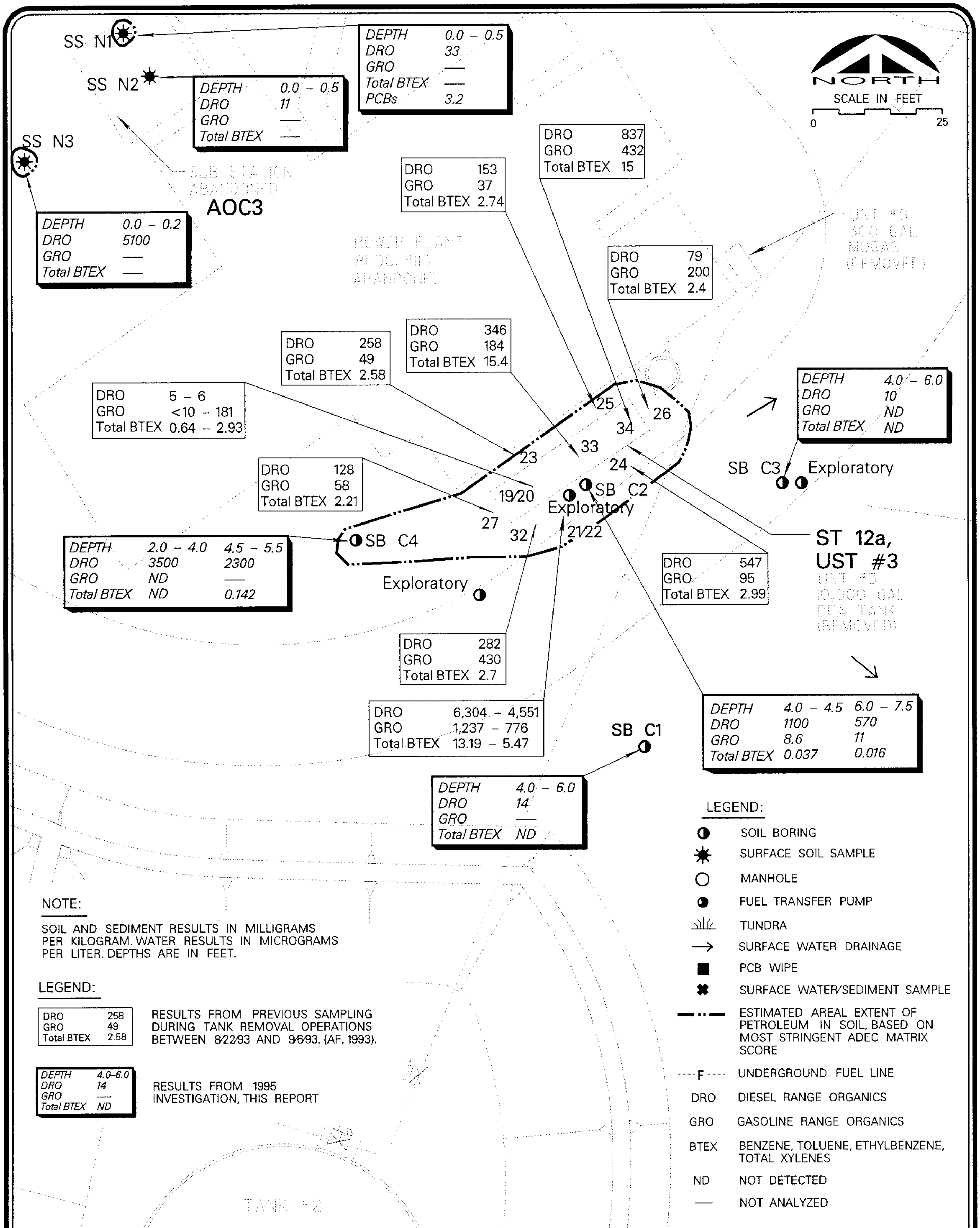


FIGURE 3–3
TIN CITY LRRS, ALASKA
LOWER CAMP (1 OF 3)
SAMPLING LOCATIONS
ST 12a & AOC 3

FILE: c:\tincity\fnlrpt\fg3_3.dgn
TIME: 01-MAY-1996 10:35
JOB No. 3380.0020

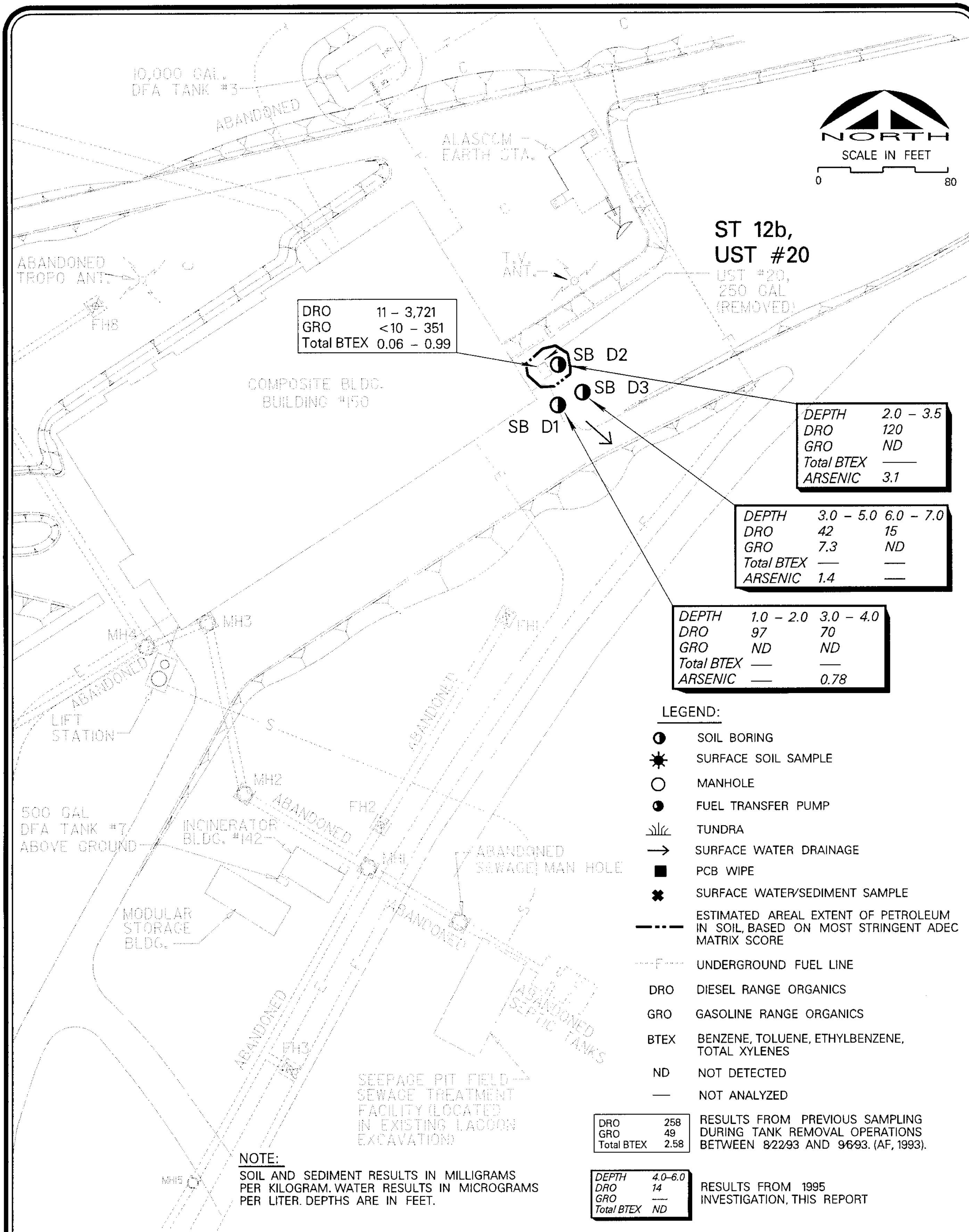


FIGURE 3–4

TIN CITY LRRS, ALASKA

LOWER CAMP (2 OF 3)
SAMPLING LOCATIONS
ST 12b, UST #20

JOB No. 3380.0020 TIME: 01-MAY-1996 10:35 FILE: c:\tincity\fnlrpt\fg3_4.dgn

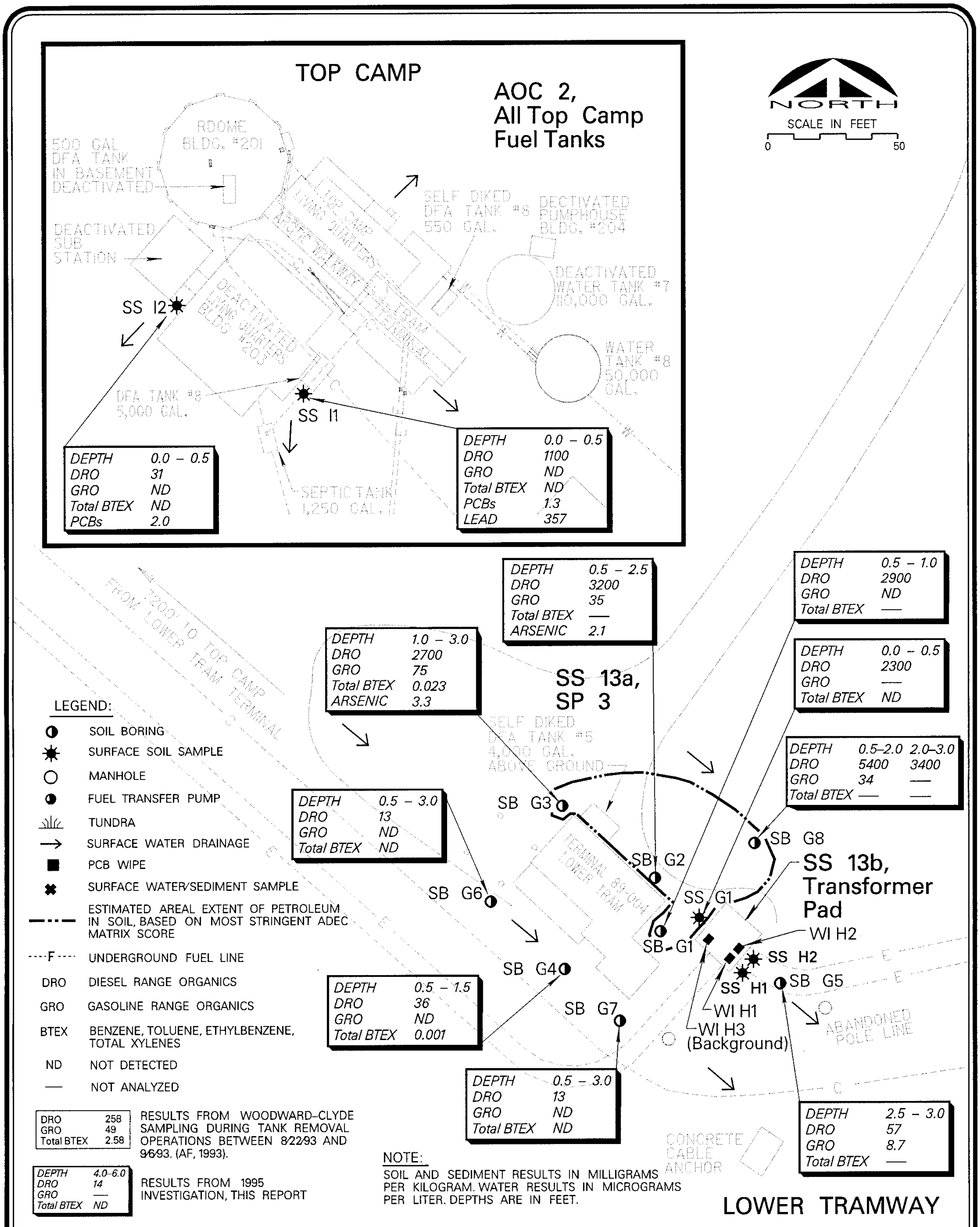
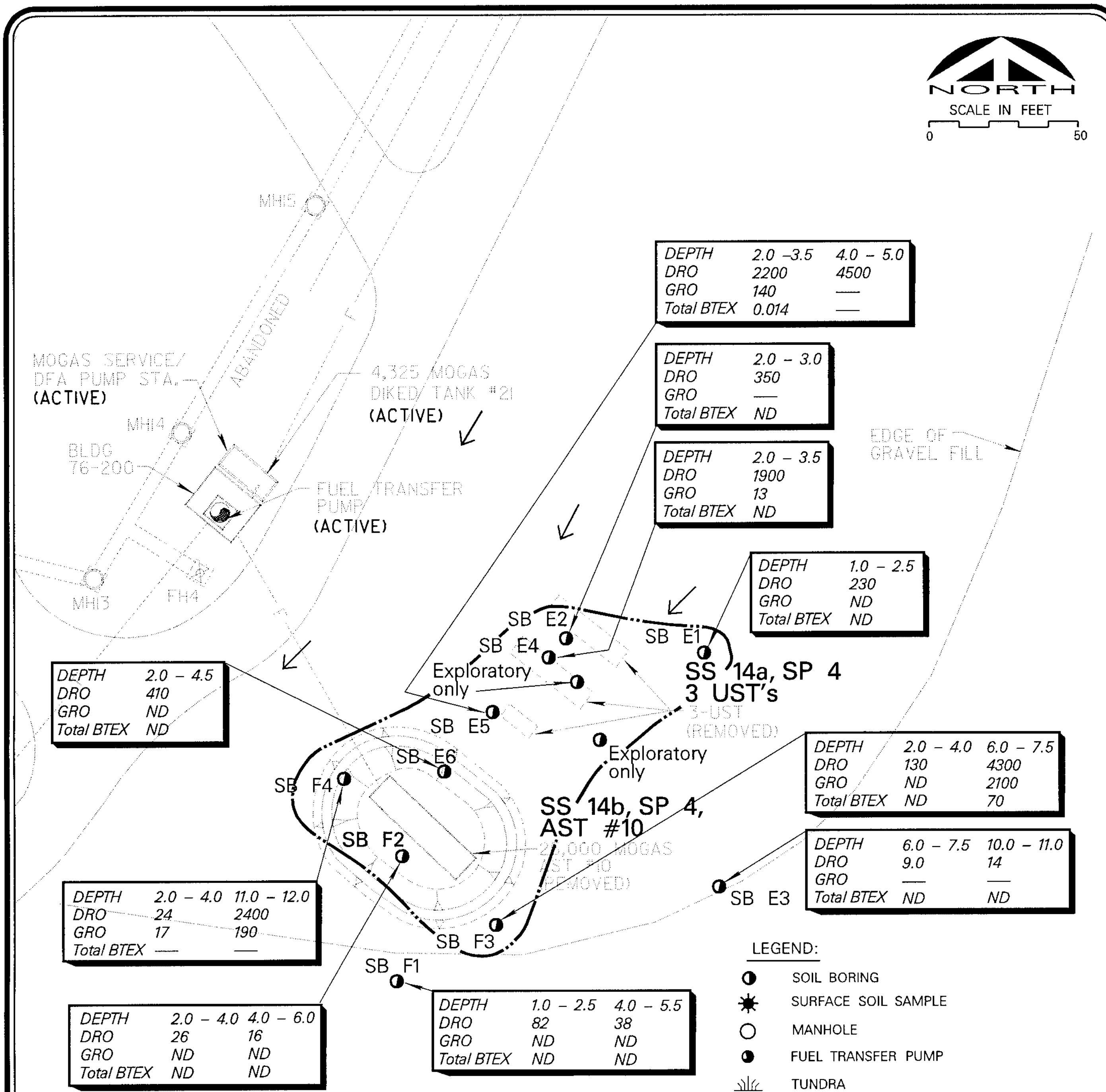


FIGURE 3–5

TIN CITY LRRS, ALASKA

LOWER TRAMWAY AND TOP CAMP SAMPLING LOCATIONS SS 13a, SS 13b & AOC 2

JOB No. 3380.0020 TIME: 01-MAY-1996 10:37 FILE: c:\tincity\fnlrpt\fg3_5.dgn



LEGEND:

◑	SOIL BORING
✹	SURFACE SOIL SAMPLE
○	MANHOLE
◕	FUEL TRANSFER PUMP
	TUNDRA
→	SURFACE WATER DRAINAGE
■	PCB WIPE
✖	SURFACE WATER/SEDIMENT SAMPLE
—··—	ESTIMATED AREAL EXTENT OF PETROLEUM IN SOIL, BASED ON MOST STRINGENT ADEC MATRIX SCORE
---F---	UNDERGROUND FUEL LINE
DRO	DIESEL RANGE ORGANICS
GRO	GASOLINE RANGE ORGANICS
BTEX	BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENES
ND	NOT DETECTED
—	NOT ANALYZED

NOTE:
SOIL AND SEDIMENT RESULTS IN MILLIGRAMS PER KILOGRAM. WATER RESULTS IN MICROGRAMS PER LITER. DEPTHS ARE IN FEET.

LEGEND:

DRO	258	RESULTS FROM WOODWARD-CLYDE SAMPLING DURING TANK REMOVAL OPERATIONS BETWEEN 8/22/93 AND 9/6/93. (AF, 1993).
GRO	49	
Total BTEX	2.58	

DEPTH	4.0-6.0	RESULTS FROM 1995 INVESTIGATION, THIS REPORT
DRO	14	
GRO	—	
Total BTEX	ND	

FIGURE 3-6

TIN CITY LRRS, ALASKA

LOWER CAMP (3 OF 3)
SAMPLING LOCATIONS
SS 14a & SS 14b

JOB No. 3380.0020 TIME: 01-MAY-1996 10:37 FILE: c:\tincity\fnlrpt\fg3_6.dgn

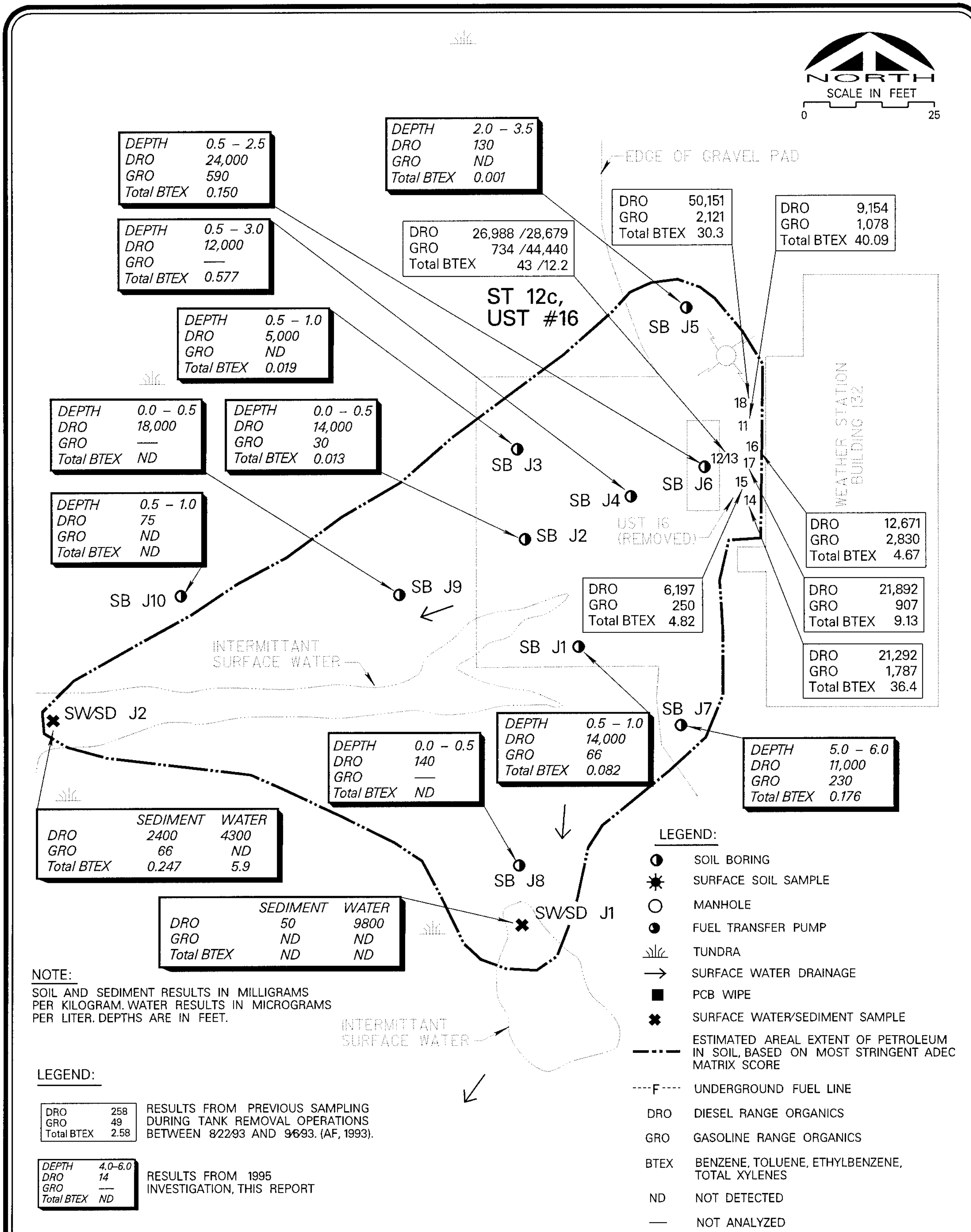


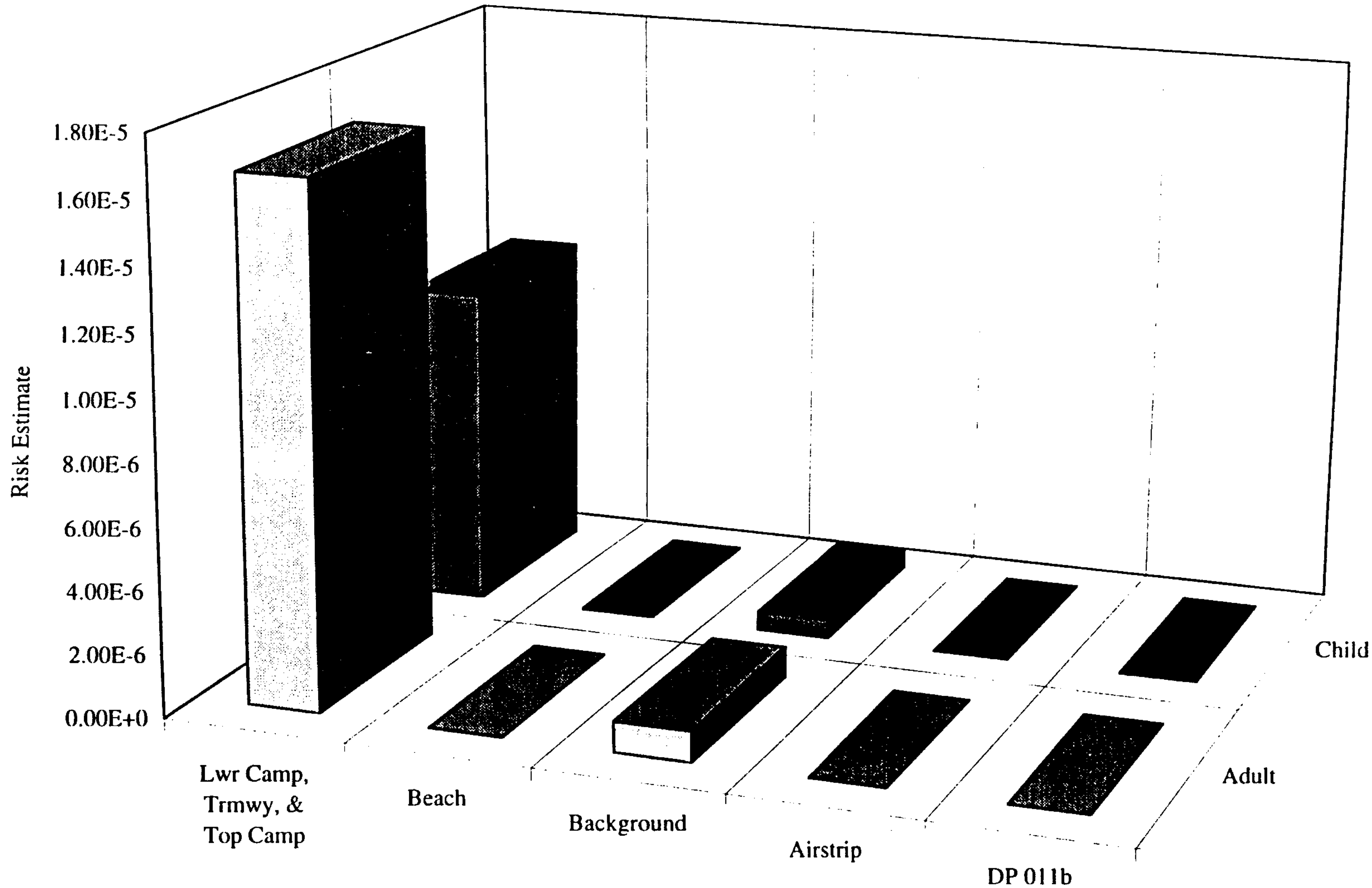
FIGURE 3–7

TIN CITY LRRS, ALASKA

AIRSTRIP SAMPLING LOCATIONS ST 12c

JOB No. 3380.0020 TIME: 01-MAY-1996 10:38 FILE: c:\tincity\fnlrpt\fg3_7.dgn

Figure 3-8. Relative Risk Levels



Tables

Table 1-1
Working Subsets of IRP Sources and AOC
Tin City LRRS

IRP Sources or AOC	Working Subset of IRP Sources and AOC	Suspected Source
DP 011	DP 11, Dump #3 at Beach	Dump # 3 at beach with abandoned drums and machinery
ST 12	ST 12a, UST #3	UST #3 (removed) at Power Plant (Bldg. 110)
	ST 12b, UST #20	UST #20 (removed) at Composite Building (Bldg. 150)
	ST 12 c, UST #16	4,000 gal. diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132
SS 13	SS 13a, SP 3	Stained soils from spill/leak #3 at lower tram (not including AST)
	SS 13b, Transformer Pad	Transformers formerly sited on stained concrete pad and soils at lower tram
SS 14	SS 14a, SP 4, 3 UST	3 USTs (removed) at SP 4 near Bldg. 76-200
	SS 14b, SP 4, AST#10	AST#10 (removed) SP 4 near Bldg. 76-200
AOC 1	AOC 1, Fuel Transfer Station	Spill/leak #5 at fuel transfer station at Bldg. 123
AOC 2	AOC 2, All Top Camp Fuel Tanks	Fuel tanks

TABLE 1–2
DP 011 - EASTERN DRUM AREA
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska

Sample I.D.	EPH (mg/Kg)	VPH (mg/Kg)	RR0 (mg/Kg)	PCBs/ Pesticides (ug/Kg)	VOCs (ug/Kg)	Semi-Volatiles (ug/Kg)	Remarks	Number of Drums/ Summary of Drum Analysis
	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Analytical Method	EPA AK 101	EPA AK 101	AK103	EPA 8080a	EPA 8260	EPA 8270a		
SS-E1: 0.5	160,000	--	30,000	--	--	--	Dark, moist, rocky soil under 3 inches of rocks. Beneath lubricant oil drums. Soils appear to be stained.	Approximate number of empty drums in Eastern Drum Area = 50
SS-E1: 2.0	47,000	ND (2.0)	57,700	ND	Toluene = 2.6J	ND	Stained, dark, moist soil with rocks interspersed.	Approximate number of drums containing product in Eastern Drum Area = 31
SS-E1: 3.5	47,800	--	61,800	--	--	--	Soil appears to be free of staining. Dark, moist soil with large rocks.	
SS-E2: 0.5	6,600	--	10,000	--	--	--	Fairly clean, dark, moist soil under 3 inches of stained soil.	Gallons of on-specification oil recovered in Eastern Drum Area= 1485
SS-E2: 2.0	190	2	350	ND	ND	ND	Dark, moist soil with many rocks interspersed throughout.	Gallons of off-specification oil recovered in Eastern Drum Area = 220
SS-E3: 0.5 (Composite)	8,200	ND (2.2)	131,000	ND	Toluene = 2.4J	ND	Dark, moist soil which appears to be stained. Composited from two locations 2 feet apart with similarly stained soil.	Approximate number of drums containing solid product = 15 (130 gallons)
SS-E4: 0.5	3,260	--	10,700	--	--	--	Fairly clean, dark, moist soil under 3 inches of stained soil.	

J = Analyte was detected above the instrument detection limit (IDL) but below the analytical reporting limit (CRDL).

ND = Analyte was not detected at the reported limit (detection limits are indicated in paranthesis where applicable).

-- = Analysis was not performed.

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TABLE 1-3
DP 011 - CENTRAL DRUM AREA
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska
August 1995

	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Sample I.D.	EPH (mg/Kg)	VPH (mg/Kg)	RRO (mg/Kg)	PCBs/ Pesticides (ug/Kg)	VOCs (ug/Kg)	Semi-Volatiles (ug/Kg)	Remarks	Number of Drums/ Summary of Drum Analysis
Analytical Method	EPA 8100M\3510	EPA 8015M/5030	AK103	EPA 8080A	EPA 8260	EPA 8270A		
SS-C1: 0.5 (Composite)	2,890	ND (3.0)	18,400	ND	ND	ND	Green, moist clay with a few interspersed rocks. Composited from three dissimilarly stained areas approximately 2 feet apart from one another.	Approximate number of empty drums in Central Drum Area = 600
SS-C1: 2.0	ND (3.0)	--	ND (10)	--	--	--	Green, moist clay. Appears to be free of staining.	Approximate number of drums containing product in Central Drum Area = 20
SS-C2: 0.5	120	ND (2.5)	110	ND	ND	ND	Dark, moist soil above green clay layer which begins at approximately 6 inches.	Gallons of on-specification oil recovered in Central Drum Area = 250
SS-C2: 2.0	6	--	12	--	--	--	Green, moist clay with interspersed rocks.	
SS-C3: 0.5	13	--	89	--	--	--	Dark, moist soil above green clay layer which begins at approximately 6 inches.	Gallons of off-specification oil recovered in Central Drum Area = 90
SS-C3: 2.0	ND (3.0)	--	ND (10)	--	--	--	Green, moist clay with a few interspersed rocks.	Number of drums containing solid product = 2 (68 gallons)

ND = Analyte was not detected at the reported limit (detection limits are indicated in paranthesis where applicable).

-- = Analysis was not requested

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TABLE 1-4
DP 011 - WESTERN DRUM AREA
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska
August 1995

	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Sample I.D.	EPH (mg/Kg)	VPH (mg/Kg)	RR0 (mg/Kg)	PCBs/ Pesticides (ug/Kg)	VOCs (ug/Kg)	Semi-Volatiles (ug/Kg)	Remarks	Number of Drums/ Summary of Drum Analysis
Analytical Method	EPA 8100M\3510	EPA 8015M/5030	AK103	EPA 8080A	EPA 8260	EPA 8270A		
SS-W1: 0.5	68,200	ND (3.0)	117,000	ND	Benzene = 2.8J Toluene = 8.0J Carbon Disulfide = 300	ND	Dark peat, below 2 inches of oily soil. Sampled under of drums formerly containing lubricants and "Dry Cleaning Solvent".	Approximate number of empty drums in Western Drum Area = 50
SS-W1: 2.0	12,000	450	66,000	ND	o-Xylene = 4.3J 1,2,4-Trimethylbenzene= 1.3J 1,3,5-Trimethylbenzene = 38	ND	Dark soil with some green clay. Sampled under of drums formerly containing lubricants and "Dry Cleaning Solvent".	Approximate number of drums containing product in Western Drum Area = 21
SS-W2: 0.5 (Composite)	8,300	--	37,500	--	--	--	Dark, moist soil under surface staining. Composited from two locations 2 feet apart with similarly stained soil.	Gallons of on-specification oil recovered in Western Drum Area = 600
SS-W2: 2.0	4,240	--	8,160	--	--	--	Dark, moist soil under surface staining.	
SS-W3: 0.5	560	ND (2.0)	3,150	ND	ND	ND	Dark, moist soil under 3 inches of stained soil. Taken from under drums formerly containing waste oil.	Gallons of off-specification oil recovered in Western Drum Area = 200
SS-W3: 2.0	830	ND (2.0)	8,100	ND	ND	ND	Dark, moist soil which appears to be free of staining.	

J = Analyte was detected above the instrument detection limit (IDL) but below the analytical reporting limit (CRDL).

ND = Analyte was not detected at the reported limit (detection limits are indicated in paranthesis where applicable).

-- = Analysis was not requested

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TABLE 1–5
DP 011 - SUB B DRUM AREA
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska

	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Sample I.D.	EPH (mg/Kg)	VPH (mg/Kg)	RRO (mg/Kg)	PCBs/ Pesticides (ug/Kg)	VOCs (ug/Kg)	Semi-Volatiles (ug/Kg)	Remarks	Number of Drums/ Summary of Drum Analysis
Analytical Method	EPA 8100M\3510	EPA 8015M/5030	AK103	EPA 8080A	EPA 8260	EPA 8270A		
SS-B1: 0.5 (Composite)	3,100	ND (2.0)	13,000	ND	ND	ND	Rocky, dark, moist soil. Staining on the top 3 inches.	Approximate number of empty drums in Sub B Drum Area = 10 Approximate number of drums containing product in Sub B Drum Area = 6 Gallons of on-specification oil recovered in Sub B Drum Area = 200 Gallons of off-specification oil recovered in Sub B Drum Area = 0 Number of drums containing solid product = 2 (100 gallons)
SS-B1: 2.0	140	ND (2.0)	680	ND	ND	Di-n-butylphthlate= 4J Butylbenzylphthalate=100J	Rocky, dark, moist soil.	

J = Analyte was detected above the instrument detection limit (IDL) but below the analytical reporting limit (CRDL).

ND = Analyte was not detected at the reported limit (detection limits are indicated in paranthesis where applicable).

TABLE 1-6
DP 011 -CRUSHED DRUM PILE A
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska
August 1995

	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Sample I.D.	**EPH (mg/Kg)**	**VPH (mg/Kg)**	**RRO (mg/Kg)**	**PCBs/ Pesticides (ug/Kg)**	**VOCs (ug/Kg)**	**Semi-Volatiles (ug/Kg)**	**Remarks**	**Number of Drums/ Summary of Drum Analysis**
Analytical Method	EPA 8100M\3510	EPA 8015M/5030	AK103	EPA 8080A	EPA 8260	EPA 8270A		
SS-CDA-1: 0.5	13	ND (2.5)	77	ND	ND	Di-n-butylphthlate = 70J	Dark, moist soil with interspersed rocks on top of light brown moist clay.	Approximate number of empty drums in Crushed Drum Pile A = 1,000
SS-CDA-1: 2.0	3	--	19	--	--	--	Light brown, moist clay.	There were no drums containing product in this area.
SS-CDA-2: 0.5	25	--	60	--	--	--	Light brown, moist clay with rocks.	
SS-CDA-3: 0.5	3.3	ND (2.1)	27	ND	Toluene = 1.3J	Di-n-butylphthlate = 33J	Light brown, moist clay.	

J = Analyte was detected above the instrument detection limit (IDL) but below the analytical reporting limit (CRDL).
ND = Analyte was not detected at the reported limit (detection limits are indicated in paranthesis where applicable).
-- = Analysis was not requested

TABLE 1-7
DP 011 - DRUM CRUSHING PAD
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska
August 1995

	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Sample I.D.	**EPH (mg/Kg)**	**VPH (mg/Kg)**	**RR0 (mg/Kg)**	**PCBs/ Pesticides (ug/Kg)**	**VOCs (ug/Kg)**	**Semi-Volatiles (ug/Kg)**	**Remarks**	**Number of Drums/ Summary of Drum Analysis**
Analytical Method	EPA 8100M\3510	EPA 8015M/5030	AK103	EPA 8080A	EPA 8260	EPA 8270A		
SS-DCP-1: 0.5	76	--	170	--	--	--	Taken from surface to 1 foot bgs. Brown moist soil with numerous rocks.	No empty drums or drums containing product were located within the drum crushing pad area.
Containment Pit	180	--	270	--	--	--		

-- = Analysis was not requested.

TABLE 1–8
DP 011 - CRUSHED DRUM PILE B
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska
August 1995

	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Sample I.D.	EPH (mg/Kg)	VPH (mg/Kg)	RR0 (mg/Kg)	PCBs/ Pesticides (ug/Kg)	VOCs (ug/Kg)	Semi-Volatiles (ug/Kg)	Remarks	Number of Drums/ Summary of Drum Analysis
Analytical Method	EPA 8100M\3510	EPA 8015M/5030	AK103	EPA 8080A	EPA 8260	EPA 8270A		
SS-CDB-1: 0.5	720	ND (3.0)	7,940	ND	Toluene = 3.1J	Di-n-butylphthlate = 95J Bis(2-Ethylhexyl)phthalate= 120J	Greenish gray, wet clay.	Approximate number of empty drums in Crushed Drum Pile B = 1,000 There were no drum containing product located in this area.
SS-CDB-1: 2.0	540	--	6,980	--	--	--	Greenish gray, wet clay.	
SS-CDB-2: 0.5	2,160	124	3,950	--	--	--	Greenish gray, wet clay.	
SS-CDB-3: 0.5	2,650	5	2,400	4,4'-DDD= 6.5	ND	ND	Greenish gray, wet clay.	

J = Analyte was detected above the instrument detection limit (IDL) but below the analytical reporting limit (CRDL).

ND = Analyte was not detected at the reported limit (detection limits are indicated in paranthesis where applicable).

-- = Analysis was not requested.

TABLE 1–9
DP 011 -CRUSHED DRUM PILE C
Analytical Methods, Results, Remarks, and Summary of Drums
Tin City LRRS, Alaska
August 1995

	Analytical Laboratory Results Soil Samples Collected on 08 Aug 1995							
Sample I.D.	EPH (mg/Kg)	VPH (mg/Kg)	RR0 (mg/Kg)	PCBs/ Pesticides (ug/Kg)	VOCs (ug/Kg)	Semi-Volatiles (ug/Kg)	Remarks	Number of Drums/ Summary of Drum Analysis
Analytical Method	EPA 8100M\3510	EPA 8015M/5030	AK103	EPA 8080A	EPA 8260	EPA 8270A		
SS-CDC-1: 0.5	350	--	450	--	--	--	Peat and dark, wet soil. Numerous roots.	Approximate number of empty drums in Crushed Drum Pile C = 1000 There were no drums containing product located in this area.
SS-CDC-1: 2.0	200	--	800	--	--	--	Dark gray, wet clay. Water enters hole within minutes.	
SS-CDC-2: 0.5	87	ND	370	ND	ND	ND	Peat and dark, wet soil.	
SS-CDC-3: 0.5	420	--	2,800	--	--	--	Peat and dark, wet soil. Water enters hole within minutes.	

ND = Analyte was not detected at the reported limit (detection limits are indicated in paranthesis where applicable).
-- = Analysis was not requested.

Table 2-1
Key to Detail Maps for IRP Sources and AOC
Tin City LRRS

Site Setting	Working Subset of IRP Sources and AOC	Detail Map Figure No.	Suspected Source Description	Suspected Contamination
Beach	DP 011, Dump #3	3-2	Dump # 3 at beach with abandoned drums and machinery	POL (lead), solvents (metals)
	AOC 1, SP 5	3-2	Spill/leak #5 at fuel transfer station at Bldg. 123	Diesel, mogas (lead)
Lower Camp, Tramway, and Top Camp	ST 12a, UST #3	3-3	UST #3 (removed) at Power Plant (Bldg. 110)	Diesel
	ST 12b, UST #20	3-4	UST #20 (removed) at Composite Building (Bldg. 150)	Waste oil (metals), runway dye, ethylene glycol
	SS 13a, SP3	3-5	Stained soils from spill/leak #3 at lower tram (not including AST)	Diesel, solvents (metals)
	SS 13b, Transformer Pad	3-5	Transformers formerly sited on stained concrete pad and soils at lower tramway terminal	Transformer oil (PCB)
	SS 14a, SP 4, 3 UST	3-6	3 USTs (removed) near 1 AST with breached berm at SP 4 near Bldg. 76-200	Diesel
	SS 14b, SP 4, AST#10	3-6	AST#10 with breached berm at SP 4 near 3 USTs (removed) and near Bldg. 76-200	Mogas (lead)
	AOC 2, All Top Camp Fuel Tanks	3-5	All fuel tanks	Diesel, lube oil (metals)
	AOC 3, Substation	3-Mar	Transformer substation	PCB
Airstrip	ST 12c, UST #16	3-7	4,000 gallon diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132	Diesel

KEY:
AST - Above-ground storage tank
IRP - Installation Restoration Program
LRRS - Long Range Radar Station
PCB - Polychlorinated biphenyl
POL - Petroleum, oil, lubricant
UST - Underground storage tank

Table 2-2
Field Strategy and Objectives
Tin City LRRS

IRP Sources or AOC	Objective	Tactics
DP 011, Dump #3 at Beach	• Investigate the presence or absence of sediment and water contamination in the ponded surface water. • Estimate the amount of surface debris for potential removal.	• Surface water and sediment samples at the inflow, outflow, and deepest part in the lake, were collected for analysis as proposed. • During the 1995 investigation, the sea did not appear to wash into or out of the ponded surface water; however, there were no significant storms during the investigation. It is probable during a 5- or 10-year storm for the sea to invade the ponded surface water and during winter for the sea ice to extend onto the beach and into the area of ponded surface water. Due to the proximity of the pond to the sea, it is likely they are connected by a subsurface hydrologic pathway. During the field investigation, the pond surface fuel receded from July 12 to July 19, 1995. Since a tidal study was not performed, it is difficult to conclude whether the recession was due to tidal effects, or if the pond received less recharge from the 12th to the 19th, due to a cooling trend that occurred during this time. • Approximately 350 drums are scattered around DP 011. Two piles of crushed drums, on the west side of DP 011 near AOC 1, are estimated to total 750 cubic yards.
AOC 1, Spill/Leak #5 at Bldg. 123 POL Pump House	• Investigate the extent of soil contamination between the fuel transfer station and the sea. Investigate the presence or absence of soil contamination on the other three sides of the fuel transfer station. • Investigate the presence or absence contaminants along potential contaminant migration pathways, such as subsurface flow toward the sea.	• Due to hand-auger refusal at approximately 1 foot below grade and poor sampler recovery, only one analytical sample per boring was collected from SB B1 through SB B5. Due to the high clay content observed at 0.5 foot below grade in SB B6, only one analytical sample was collected from this boring above the sandy clay layer. Therefore, no PID comparisons were made of samples collected from multiple depths. • The monitoring well point was unnecessary due to the presence of a saturated sandy clay at 0.5 foot below grade, along the sea side area of the berm. • The surface water and sediment sample was collected along the sea side area of the berm (location SW/SD B1), where the well point was proposed. An additional surface water sample was collected from a surface water seep (location SW B2) approximately 50 feet downgradient of the former POL pumphouse.

Table 2-2
Field Strategy and Objectives
Tin City LRRS

IRP Sources or AOC	Objective	Tactics
ST 12a, UST #3	• Investigate the extent of hydrocarbon contamination in two directions. • Collect information on whether the tanks are regulated or unregulated under the Alaska UST program.	• Boring SB C2 was placed in the center of the former tank location. Permafrost was encountered in this boring at approximately 7 feet below grade. An analytical sample was collected at the permafrost interface as proposed. The near-surface sample (for risk assessment) was collected at the first sample location in this boring, approximately 5 feet below ground surface (bgs). The initial boring SB C2a was considered an exploratory boring due to unsatisfactory sample recovery. • Two peripheral borings SB C3 and SB C4 were drilled to depths of 6 and 4 feet bgs, respectively. The auger was difficult to advance at the bottom of these borings, likely due to the presence of limestone bedrock or limestone boulders. Each boring had an initial exploratory boring, SB C3a and SB C4a, both with unsatisfactory sample recovery. SB C3a was drilled to 9 feet bgs, with difficulty, to confirm the presence of bedrock. The cuttings from SB C3a were of pulverized limestone. Two analytical samples were collected from each boring, SB C3 and SB C4, as proposed. An additional boring, SB C1, was drilled in a peripheral location and sampled at approximately 5 feet bgs. • The UST at this site was regulated, since it contained diesel or gasoline. All the tanks at Tin City LRRS containing diesel, gasoline, or waste oil, were regulated.
ST 12b, UST #20	• Investigate the extent of hydrocarbon contamination in two directions. • Collect information on whether the tanks are regulated or unregulated under the Alaska UST program.	• Boring SB D2 was placed in the center of the former tank location. Due to auger refusal and rock fragments encountered from 4 to 6 feet bgs, only one analytical sample at approximately 3 feet bgs was collected. Moving the boring location was not an option at this location due to the restricted area and the underground utilities nearby. • Analytical samples were collected from two peripheral borings, SB D1 and SB D3, as proposed. • The UST at this site was regulated, since it contained waste oil. All the tanks at Tin City LRRS containing diesel, gasoline, or waste oil, were regulated.

Table 2-2
Field Strategy and Objectives
Tin City LRRS

IRP Sources or AOC	Objective	Tactics
ST 12c, UST #16	• Investigate the extent of hydrocarbon contamination at the former tank location. • Investigate the presence or absence potential contaminant migration pathways, such as subsurface flow from the gravel pad. If potential migration pathway is present, investigate the presence or absence of hydrocarbon constituents. • Collect information on whether the tanks are regulated or unregulated under the Alaska UST program.	• Boring SB J6 was placed at the center of the former tank location and sampled for analysis as proposed. Permafrost was encountered in SB J6 at approximately 5 feet bgs. • Construction of a vadose well in SB J6 was not warranted due to the permafrost encountered at approximately 5 feet bgs, which would not allow the well to be constructed according to specifications. • Six peripheral borings, SB J1, J2, J3, J4, J5, and J7, were installed at the site. In addition, three peripheral borings, SB J8, J9, and J10, were also installed to further assess the soils laterally. Borings SB J4, J5, J6, and J7 were installed using a drilling rig due to their location on the gravel pad. The remaining borings at the site were drilled using a hand-auger. Due to auger refusal in these borings at relatively shallow depths, only one analytical sample was collected from each boring. • Two surface water and sediment samples, SW/SD J1 and SW/SD J2, were collected for analysis at this site, which was one additional surface water sample than proposed. • The area in the vicinity of SB J4 was not favorable for construction of a monitoring well due to the slope and loose consistency of soils. MW did not elect to install a well in nearby SB J1, SB J2, and SB J3, due to the presence of water within 1 foot bgs in these borings. Nearby SB J6 was not favorable for construction of a monitoring well since no groundwater was encountered in SB J6. • The former UST, which contained heating oil for the weather station building, was non-regulated.

Table 2-2
Field Strategy and Objectives
Tin City LRRS

IRP Sources or AOC	Objective	Tactics
SS 13a, SP 3	• Investigate the horizontal extent of hydrocarbon contamination in the direction of the transformer pad. • Investigate the presence or absence of hydrocarbon contamination beside the LTT.	• Five borings around the LTT, SB G1, G2, G3, G4, and G6, and one boring downgradient of the transformer pad, SB G5, were installed as proposed. Two additional borings, SB G7 and SB G8, were installed in the peripheral locations. Bedrock was encountered at 2 to 5 feet bgs in the borings. Since MW was limited in its investigation vertically, the additional borings were installed to investigate the area laterally. Rig access to SB G1 was not possible due to the potential of encountering underground utilities; thus, SB G1 was bored using a hand auger, as was SB G5. • Due to poor sample recovery at depth and shallow bedrock, only one sample for analysis was collected from each of the borings SB G1 through SB G7, and two samples for analysis were collected from SB G8. One surface sample, SS G1, was collected from approximately 5 feet upgradient of the transformer pad. This surface sample was not originally proposed. • Central borehole SB G3 was not completed as a vadose well due to the shallow bedrock encountered at approximately 4.5 feet bgs. A vadose well could not be constructed according to specifications, given the subsurface conditions. • The site was deemed unfavorable for intrinsic remediation due to the coarse-grained nature of the soils and shallow bedrock.
SS 13b, Transformer Pad	• Investigate the presence or absence of PCB on the concrete transformer pad. • Investigate the presence/absence and extent of PCB contamination in surface soils adjacent to the transformer pad.	• Two PCB wipe samples, WI H1 and WI H2, were collected at the transformer pad as proposed. In addition, a background wipe and solvent wipe were submitted to the laboratory as WI H3 and WI H4, respectively. • Two surface soil samples, SS H1 and SS H2, were collected immediately downgradient of the transformer pad. Three surface soil samples were originally proposed for this site, but one was eliminated per USAF.

Table 2-2
Field Strategy and Objectives
Tin City LRRS

IRP Sources or AOC	Objective	Tactics
SS 14a, SP 4, 3 UST	• Investigate the extent of hydrocarbon contamination in two directions. • Collect information on whether the tanks are regulated or unregulated under the Alaska UST program.	• Boring SB E2 was placed in the (assumed) center of the former tank location. Due to auger refusal at approximately 4 feet bgs, and rock fragments encountered at 3 feet bgs, only one analytical sample was collected at approximately 2.5 feet bgs. Initial exploratory borings SB E2a and SB E2b were drilled nearby and exhibited similar subsurface conditions. • MW and USAF elected not to install a vadose well in the vicinity of SB E2, due to the very dense nature of subsurface soils and rock observed in SB E1, E2a, E2b, E2, and E4. • Five peripheral borings were drilled at this site, SB E1, E4, E5 and E6, although only two peripheral borings were proposed. The additional borings were drilled to further assess the site laterally. Permafrost was encountered in SB E3 at approximately 10 feet bgs. Borings SB E1, E4, E5, and E6 were terminated at 4 to 5 feet bgs, due to auger refusal on suspected bedrock (limestone). Analytical samples were collected from SB E3 and SB E5, as proposed. One analytical sample was collected from each of the borings, SB E1, SB E4 and SB E6. • No surface water was observed near this site; therefore, no surface water samples were collected. No groundwater was encountered at this site. • The USTs at this site were regulated, since they contained diesel or gasoline. All the tanks at Tin City LRRS containing diesel, gasoline, or waste oil, were regulated.
SS 14b, SP 4, AST #10	• Investigate the presence or absence of hydrocarbon contamination in two directions. • Collect information on whether the tanks are regulated or unregulated under the Alaska UST program.	• Boring SB F2 was placed in the (assumed) center of the former tank location. Permafrost was encountered in SB F2 at approximately 4.5 feet bgs. Samples were collected for analysis in SB F2, as proposed. • Two peripheral borings were drilled, SB F3 and SB F4, to depths of 10.5 and 17 feet bgs. Both of these borings were terminated due to auger refusal in very dense, coarse-grained soil. Samples in these borings were collected for analysis as proposed; however, due to poor recovery of samples from the bottom of each boring, the samples from approximately 7 and 12 feet bgs in SB F3 and SB F4 were submitted as bottom samples. An additional boring, SB F1, was drilled in a peripheral location and analytical samples were collected at approximately 2 and 5 feet bgs. Boring SB F1 was terminated due to auger refusal. • No surface water was observed near this site; therefore, no surface water samples were collected. No groundwater was encountered at this site.

Table 2-2
Field Strategy and Objectives
Tin City LRRS

IRP Sources or AOC	Objective	Tactics
AOC 2, All Top Camp Fuel Tanks	• Identify presence or absence of hydrocarbon contaminants in areas showing visual indications of potential contamination. Exact AOC are not currently identified.	• As discussed with USAF personnel on-site, two surface soil samples, SS I1 and SS I2, were collected in potentially contaminated areas, near a former AST tank pad and next to a substation. Otherwise, the remaining areas at the Top Camp did not appear to warrant laboratory analysis. A third surface sample designated for this site was not collected, per USAF.
AOC 3	• Investigate the presence or absence of PCBs.	• Two surface soil samples were collected for analysis from inside a substation containing two transformer pads. One surface sample was collected from a location adjacent to each pad. An additional surface soil sample was collected for analysis at a location approximately 25 feet in front of the building. These samples were not originally proposed.

KEY:

LRRS - Long Range Radar Station
LTT - Long Tramway Terminal
MW - Montgomery Watson
PCB - Polychlorinated biphenyls
PID - Photoionization detector
POL - Petroleum, oil, lubricants
SB - Soil boring
SW/SD - Surface water/sediment
USAF - United States Air Force
UST - Underground storage tank

Table 2-3
Summary of Planned and Actual Field Investigation Activities
1995 Field Investigation
Tin City LRRS, Alaska

Site Setting	IRP Sources and AOC	Site Recon	Surface and Subsurface Soil Investigation								Subsurface Water Investigation				Surface Water/Sediment Investigation				PCB Surface Wipes		Remedial Planning	
			Rig Dug Boreholes		Hand Dug Boreholes		Maximum Depth of Borehole (feet)		Surface Soil Only (SS)		Hand Dug Temporary Well Point		Monitoring Well (from borehole)		Surface Water Samples (SW)		Sediment Samples (SD)				Bioventing Injection Point (from borehole)	
			Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Beach	DP 011, Dump #3	1					NA								3	3	3	3				
	AOC 1, SP 5	1			5	6	5	1			1	0			0	2	0	1				
Lower Camp, Tramway, and Top Camp	ST 12a, UST #3	1	3	7*			20	10														
	ST 12b, UST #20	1	3	3			20	9.5														
	SS 13a, SP3	1	0	6	5	2	5	5	0	1											1	0
	SS 13b, Transformer Pad	1					NA		2	2									2	2		
	SS 14a, SP 4, 3 UST	1	3	8**			20	12													1	0
	SS 14b, SP-4, AST#10	1	3	4			20	17														
	AOC 2, All Top Camp Fuel Tanks	1			6	0	5	0	0	2												
	AOC 3, Substation	1							0	3												
Air Strip	ST 12c, UST #16	1	4	4	3	6	10	6.5					1	0	1	2	2	2			1	0
Other	Reserves	1			14		5														1	0
	Background	1		2***	3	0	5	NA	0	3					0	3						
Total		**13**	**16**	**34**	**36**	**14**	**NA**	**NA**	**2**	**11**	**1**	**0**	**1**	**0**	**4**	**10**	**5**	**6**	**2**	**2**	**4**	**0**

Key:
PCB - Polychlorinated biphenyl
NA - Not applicable
DRO - Diesel range organics
IRP - Installation Restoration Program

Footnotes:
* Three exploratory soil borings drilled (SB C2a, SB C3a, SB C4a), but not sampled.
** Two exploratory soil borings drilled (SB E2a, SB E2b), but not sampled.
*** Two background soil borings drilled (SB K1, SB K2); neither sampled. Surface soil and water samples taken instead.

Table 2-4
Chronology of Field Work 1995
Tin City LRRS

Date	Location	Type	Site ID	Remarks
Day 1, July 10 (Mon.)				Field team arrived on-site, organized equipment and set up field mobilization area Reconnoitered site and marked drilling positions after AFCEE on-site personnel approval
Day 2, July 11 (Tues.)	SS 13a	Soil boring, hand auger	G-1,G-5	No drilling permit issued
	SS 13b	PCB wipe	H-1,2,3,4	
		Surface soil	H-1,H-2	
	ST 12c	Soil boring, hand auger	J-1,2,3,8,9,10	
	BKG	Soil boring, hand auger	K-1	
	AOC 1	Soil boring, hand auger	B-1,2,3,4,5,6	
	QC	(hand auger)	L-1	
Day 3, July 12 (Wed.)	AOC 2	Surface soil	I-1, I-2	No drilling permit issued, John DeGeorge on standby at 1230
	Prep	--		
	ST 12c	Surface water/Sediment	J-1, J-2	
	DP 011	Surface water/Sediment	A-1,2,3 (MS/MSD)	
	QC	(dredge, ss spoons)	L-2, L-3	
Day 4, July 13 (Thur.)	Prep	--		No drilling permit issued, John DeGeorge on standby at 1230
	AOC 3	Surface soil	N-1,2,3	
	AOC 1	Surface water/Sediment	B-1, B-2	
	BKG	Surface water	K-1,2,3	
		Surface soil	K-2 (gravel), K-2 (MS/MSD)	
	QC	(ss spoons)	L-4	

Table 2-4
Chronology of Field Work 1995
Tin City LRRS

Date	Location	Type	Site ID	Remarks
Day 5, July 14 (Fri.)	Prep	--		Drill permit issued 1100 for Site C,E,F
	ST 12a	Soil boring, drill rig	C-2a,b, C-3a,b, C-4a,b	Doug Quist and Tim Sherman (AFCEE) left site in the afternoon for Nome
	QC	(split spoon)	L-5	Abandoned septic lines reconned, no samples collected
	Prep	--		
Day 6, July 15 (Sat.)	SS 14a	Soil boring, drill rig	E-3, E-2a,b,c, E-1,5,4,6	Brett Berglund, AFCEE leave site in the afternoon for Nome
	SS 14b	Soil boring, drill rig	F-2, F-4 (MS/MSD)	
	QC	(split spoon)	L-6	
	Prep	--		
Day 7, July 16 (Sun.)	SS 14b	Soil boring, drill rig	F-3, F-1	
	ST 12a	Soil boring, drill rig	C-1	
	ST 12b	Soil boring, drill rig	D-2	
	QC	(split spoon)	L-7	
	Prep	--		
Day 8, July 17 (Mon.)	ST 12b	Soil boring, drill rig	D-1, D-3	
	SS 13a	Soil boring, drill rig	G-4,3,6,7,2,1,8	
Day 9, July 18 (Tues.)	QC	(split spoon)	L-8	
	Prep	--		
	ST 12c	Soil boring, drill rig	J-5,4,6,7	
	BKG	Soil boring, drill rig	K-1b	(not sent to lab, replaced by K-1 peat sample)

Table 2-4
Chronology of Field Work 1995
Tin City LRRS

Date	Location	Type	Site ID	Remarks
Day 10, July 19 (Wed.)	SS 13a	Soil boring Surface soil (split spoon)	G-1, G-5 H-1, H-2 L-10	
	QC			
	Prep			Prepared bottles for resampling
Day 11, July 20 (Thur.)	Prep			Resample completed
	AOC 1	Soil boring	B-1,2,3,4,5,6	
	BKG	Surface soil	K-1 (peat), K-3 (tundra)	
	SS 13b	PCB wipe	H-1,2,3,4	
	AOC 2	Surface soil	I-1, I-2	
	Prep			Packed samples and field equipment
Day 12, July 21 (Fri.)				Completed: Dangerous goods document DD Form 1149s Cargo load worksheet Equipment loadout Equipment palletized B. McLean left site, arrived Anchorage

Location:

AOC 1	Spill/leak #5 at fuel transfer station at Bldg. 123
AOC 2	Fuel Tanks
AOC 3	Substation
BKG	Background
DP 011	Dump #3 at beach with abandoned drums and machinery
QC	Field Quality Control
SS 13a	Stained soils from spill/leak #3 at lower tram (not including AST)
SS 13b	Transformers formerly sited on stained concrete pad and soils at lower tram
SS 14a	3 USTs (removed) at SP 4 near Bldg. 76-200
SS 14b	AST#10 (removed) SP 4 near Bldg. 76-200
ST 12a	UST #3 (removed) at Power Plant (Bldg. 110)
ST 12b	UST #20 (removed) at Composite Building (Bldg. 150)
ST 12c	4,000 gal. diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132

Key:

AFCEE	Air Force Center for Environmental Excellence
MS/MSD	Matrix Spike/Matrix Spike Duplicate
PCB	Polychlorinated Biphenyls
Prep	Packed samples for shipping/field work preparations

Table 2-5
Field Work Changes from Work Plan
Tin City LRRS

Site	Change	Action	Remark
Beach			
DP 011	None		
AOC 1	Well points	Deleted	No apparent groundwater observed
Lower Camp, Tramway and Top Camp			
ST 12a	Soil borings	Expanded	To determine the presence or absence of contamination
ST 12b	None		
SS 13a	Soil borings	Expanded	
SS 13b	None		
SS 14a	Soil borings		
SS 14b	Soil borings		
	Soil vapor	Wells deleted	Tight soils, shallow bedrock
AOC 2	Surface soils	Decrease	Only 2 above-ground storage tank locations identified
Airstrip			
ST 12c	Monitoring wells	Deleted	No apparent groundwater observed
Substation			
AOC 3	Surface soil (PCB)	Added	Apparent soil contamination observed

TABLE 2-6
TIN CITY LRRS
Chain-of-Custody Log Summary by Location

IRP Site	*Location*	*Sample ID*	*Sample Date/Time*		*List of Analytes*	*Lab No.*	*COC No.*
AOC 1	**SW/SD B1**	95TCB001SD	07/13/95	1330	GRO, DRO/RRO, Lead, SVOC	9510074	5
AOC 3	**SS N1**	95TCN001SS	07/13/95	1700	DRO/RRO, PEST/PCBs	9510075	5
	SS N2	95TCN002SS	07/13/95	1705	DRO/RRO, PEST/PCBs	9510076	5
	SS N3	95TCN003SS	07/13/95	1710	DRO/RRO, PEST/PCBs	9510077	5
BKG	**SS K2**	95TCK002SS	07/13/95	1815	GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	9510078	5
ST 12a	**SB C2**	95TCC002SB5.0	07/14/95	1320	BTEX, GRO, DRO, SVOC, PID	9510079	5
		95TCC002SB7.0	07/14/95	1340	BTEX, GRO, DRO, SVOC, PID	9510080	5
	SB C3	95TCC003SB5.0	07/14/95	1530	BTEX, GRO, DRO, SVOC, PID	9510081	5
	SB C4	95TCC004SB3.0	07/14/95	1630	BTEX, GRO, DRO, PID	9510082	5
		95TCC004SB5.0	07/14/95	1605	BTEX, DRO/RRO, PID	9510083	5
SS 14a	**SB E3**	95TCE003SB7.0	07/15/95	900	BTEX, DRO, PID	9510085	5
		95TCE003SB11.0	07/15/95	1000	BTEX, DRO, PID	9510086	5
SS 13a	**SB G1**	95TCG001SB01	07/11/95	1100	PID	9510110	1
	SB G5	95TCG005SB03	07/11/95	1150	PID	9510111	1
ST 12c	**SB J1**	95TCJ001SB01	07/11/95	1340	PID	9510118	1
	SB J2	95TCJ002SB01	07/11/95	1400	PID	9510119	1
	SB J3	95TCJ003SB01	07/11/95	1410	PID	9510120	1
	SB J8	95TCJ008SB01	07/11/95	1420	PID	9510121	1
	SB J9	95TCJ009SB01	07/11/95	1430	PID	9510122	1
AOC 2	**SS I2**	95TCI002SS	07/12/95	930	PID	9510127	1
DP 011	**SW/SD A1**	95TCA001SW	07/12/95	1800	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	9510159	2
		95TCA001SD	07/12/95	1805	VOC, GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	9510160	2
	SW/SD A2	95TCA002SW	07/12/95	1810	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	9510161	2
		95TCA002SD	07/12/95	1815	VOC, GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	9510162	2
	SW/SD A3	95TCA003SW	07/12/95	1820	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	9510163	2
		95TCA003SD	07/12/95	1825	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	9510164	2
		95TCA603SW	07/12/95	1830	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	9510165	2

TABLE 2-6
TIN CITY LRRS
Chain-of-Custody Log Summary by Location

IRP Site	*Location*	*Sample ID*	*Sample Date/Time*		*List of Analytes*	*Lab No.*	*COC No.*
ST 12c	**SW/SD J1**	95TCJ001SW	07/12/95	1530	BTEX, GRO, DRO, SVOC, PEST/PCBs	9510166	2
		95TCJ001SD	07/12/95	1530	BTEX, GRO, DRO/RRO, SVOC, PEST/PCBs	9510167	2
	SW/SD J2	95TCJ002SW	07/12/95	1600	BTEX, GRO, DRO, SVOC, PEST/PCBs	9510168	2
		95TCJ002SD	07/12/95	1630	BTEX, GRO, DRO/RRO, SVOC, PEST/PCBs	9510169	2
AOC 1	**SW/SD B1**	95TCB001SW	07/13/95	1340	BTEX, GRO, DRO, Lead, SVOC	9510201	4
	SW/SD B2	95TCB002SW	07/13/95	1500	BTEX, GRO, DRO, Lead, SVOC	9510202	4
BKG	**SW/SD K1**	95TCK001SW	07/13/95	1800	VOC, Metals, SVOC, PEST/PCBs	9510203	4
	SW/SD K2	95TCK002SW	07/13/95	1830	VOC, Metals, SVOC, PEST/PCBs	9510204	4
	SW/SD K3	95TCK003SW	07/13/95	2100	VOC, Metals, SVOC, PEST/PCBs	9510205	4
SS 14a	**SB E1**	95TCE001SB2.0	07/15/95	1330	BTEX, DRO, PID	9510270	6
	SB E2	95TCE002SB3.0	07/15/95	1245	BTEX, DRO, PID	9510271	6
	SB E4	95TCE004SB3.0	07/15/95	1415	BTEX, GRO, DRO/RRO, SVOC, PID	9510272	6
	SB E5	95TCE005SB3.0	07/15/95	1345	BTEX, GRO, DRO, SVOC, PID	9510274	6
		95TCE005SB5.0	07/15/95	1400	DRO, PID	9510275	6
	SB E6	95TCE006SB3.0	07/15/95	1630	BTEX, GRO, DRO/RRO, SVOC, PID	9510276	6
SS 14b	**SB F2**	95TCF002SB3.0	07/15/95	1745	BTEX, GRO, DRO, PID	9510277	6
		95TCF002SB5.0	07/15/95	1800	BTEX, GRO, DRO, PID	9510278	6
	SB F4	95TCF004SB3.0	07/15/95	1845	VOC, GRO, DRO, PID	9510279	6
		95TCF004SB12.0	07/15/95	2000	VOC, GRO, DRO, Lead, SVOC, PID	9510280	6
	SB F1	95TCF001SB2.0	07/15/95	1430	BTEX, GRO, DRO, Lead, SVOC, PID	9510281	6
		95TCF001SB5.0	07/15/95	1445	BTEX, GRO, DRO, PID	9510282	6
	SB F3	95TCF003SB3.0	07/16/95	1130	BTEX, GRO, DRO, PID	9510283	6
		95TCF003SB7.0	07/16/95	1300	BTEX, GRO, DRO, Lead, SVOC, PID	9510284	6
ST 12a	**SB C1**	95TCC001SB5.0	07/16/95	1600	BTEX, DRO, PID	9510285	6
ST 12b	**SB D2**	95TCD002SB2.0	07/16/95	1830	VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol, PID	9510288	6
	SB D1	95TCD001SB2.0	07/17/95	930	VOC, GRO, DRO/RRO, SVOC, PID	9510289	7
		95TCD001SB4.0	07/17/95	1015	VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol, PID	9510292	7

TABLE 2-6
TIN CITY LRRS
Chain-of-Custody Log Summary by Location

IRP Site	*Location*	*Sample ID*	*Sample Date/Time*		*List of Analytes*	*Lab No.*	*COC No.*
ST 12b	**SB D3**	95TCD003SB4.0	07/17/95	1030	VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol, PID	9510293	7
		95TCD003SB7.0	07/17/95	1200	VOC, GRO, DRO/RRO, SVOC, PID	9510294	7
SS 13a	**SB G3**	95TCG003SB2.0	07/17/95	1430	VOC, BTEX, GRO, DRO/RRO, Metals, SVOC, PID	9510295	7
	SB G4	95TCG004SB1.5	07/17/95	1500	BTEX, GRO, DRO, PID	9510296	7
	SB G6	95TCG006SB02.0	07/17/95	1530	BTEX, GRO, DRO, PID	9510297	7
	SB G7	95TCG007SB01.5	07/17/95	1630	BTEX, GRO, DRO, PID	9510298	7
	SS G1	95TCG001SS	07/17/95	1830	BTEX, DRO	9510299	7
	SB G2	95TCG002SB01.5	07/17/95	1800	VOC, GRO, DRO/RRO, Metals, SVOC, PID	9510300	7
	SB G8	95TCG008SB01.5	07/17/95	1900	VOC, GRO, DRO/RRO, SVOC, PID	9510301	7
		95TCG008SB03.0	07/17/95	1915	VOC, DRO/RRO, PID	9510302	7
SS 13b	**WI H1**	95TCH001WI	07/19/95	1610	PCBs	9510432	12
	WI H2	95TCH002WI	07/19/95	1620	PCBs	9510433	12
	WI H3	95TCH003WI	07/19/95	1630	PCBs	9510434	12
	WI H4	95TCH004WI	07/19/95	1640	PCBs	9510435	12
AOC 1	**SB B1**	95TCB001SB1.0	07/19/95	900	BTEX, GRO, DRO, SVOC	9510436	12
	SB B2	95TCB002SB1.0	07/19/95	915	BTEX, GRO, DRO, SVOC	9510437	12
	SB B3	95TCB003SB1.0	07/19/95	930	BTEX, GRO, DRO, SVOC	9510438	12
	SB B4	95TCB004SB1.0	07/19/95	945	BTEX, GRO, DRO, SVOC	9510439	12
	SB B5	95TCB005SB1.0	07/19/95	1000	BTEX, GRO, DRO/RRO, Lead, SVOC	9510440	12
	SB B6	95TCB006SB1.0	07/19/95	1015	BTEX, GRO, DRO/RRO, Lead, SVOC	9510441	12
BKG	**SS K1**	95TCK001SS	07/19/95	1430	BTEX, GRO, DRO/RRO, Lead, SVOC, PCBs	9510442	12
	SS K3	95TCK003SS	07/19/95	1445	BTEX, GRO, DRO/RRO, Lead, SVOC, PCBs	9510443	12
DP 011	**SW/SD A1**	95TCA001SW	07/19/95	1630	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	9510445	12
	SW/SD A3	95TCA003SW	07/19/95	1700	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	9510446	12
ST 12c	**SB J4**	95TCJ004SB01.5	07/18/95	1030	BTEX, DRO, PID	9510448	8
	SB J5	95TCJ005SB03.0	07/18/95	1040	BTEX, GRO, DRO, SVOC, PID	9510449	8
	SB J6	95TCJ006SB01.5	07/18/95	1330	BTEX, GRO, DRO, SVOC, PID	9510450	8

TABLE 2-6
TIN CITY LRRS
Chain-of-Custody Log Summary by Location

IRP Site	*Location*	*Sample ID*	*Sample Date/Time*		*List of Analytes*	*Lab No.*	*COC No.*
ST 12c	**SB J6**	95TCJ006SB5.5	07/18/95	1400	BTEX, GRO, DRO/RRO, SVOC, PID	9510451	8
	SB J1	95TCJ001SB1.0	07/19/95	1300	BTEX, GRO, DRO, SVOC	9510452	9
	SB J2	95TCJ002SB1.0	07/19/95	1315	BTEX, GRO, DRO, SVOC	9510453	9
	SB J3	95TCJ003SB1.0	07/19/95	1330	BTEX, DRO, PID	9510454	9
	SB J9	95TCJ009SB1.0	07/19/95	1400	BTEX, DRO, PID	9510455	9
	SB J8	95TCJ008SB1.0	07/19/95	1345	BTEX, DRO, PID	9510456	9
	SB J10	95TCJ010SB1.0	07/19/95	1415	BTEX, GRO, DRO, SVOC	9510457	9
AOC 2	**SS I1**	95TCI001SS	07/19/95	1600	BTEX, GRO, DRO/RRO, Lead, SVOC, PEST/PCBs	9510458	9
	SS I2	95TCI002SS	07/19/95	1630	BTEX, GRO, DRO/RRO, Lead, SVOC, PEST/PCBs, PID	9510459	9
SS 13b	**SS H1**	95TCH001SS	07/19/95	1130	GRO, PEST/PCBs	9510460	10
	SS H2	95TCH002SS	07/19/95	1200	GRO, PEST/PCBs	9510461	10
SS 13a	**SB G1**	95TCG001SB1.0	07/19/95	1100	VOC, GRO, DRO/RRO, SVOC	9510462	10
	SB G5	95TCG005SB3.0	07/19/95	1115	VOC, GRO, DRO/RRO	9510463	10
ST 12c	**SB J7**	95TCJ007SB5.5	07/18/95	1600	BTEX, GRO, DRO, SVOC, PID	9510465	11
QC	**RI L02**	95TCL002RI	07/12/95	1900	VOC, GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	95TCL002RI	3
	RI L03	95TCL003RI	07/12/95	1930	VOC, GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	95TCL003RI	3
	RI L04	95TCL004RI	07/13/95	1900	VOC, GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	95TCL004RI	4
	RI L05	95TCL005RI	07/14/95	1915	VOC, GRO, DRO/RRO, SVOC	95TCL005RI	5
	RI L06	95TCL006RI	07/15/95	1100	BTEX, GRO, DRO/RRO, SVOC	95TCL006RI	5
	RI L07	95TCL007RI	07/16/95	1915	VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol	95TCL007RI	6
	RI L08	95TCL008RI	07/17/95	1915	VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol	95TCL008RI	7
	RI L10	95TCL010RI	07/19/95	1915	VOC, GRO, DRO/RRO, Lead, SVOC, PEST/PCBs	95TCL010RI	10
	RI L09	95TCL09RI	07/18/95	1915	VOC, GRO, DRO/RRO, SVOC	95TCL09RI	11
	TB M02	95TCM002TB	07/12/95	1915	BTEX, GRO	95TCM002TB	2
	TB M03	95TCM003TB	07/12/95	1930	VOC, GRO	95TCM003TB	3
	TB M04	95TCM004TB	07/13/95	1915	VOC, GRO	95TCM004TB	4
	TB M05	95TCM005TB	07/14/95	1900	VOC, GRO	95TCM005TB	5

TABLE 2-6
TIN CITY LRRS
Chain-of-Custody Log Summary by Location

IRP Site	*Location*	*Sample ID*	*Sample Date/Time*	*List of Analytes*	*Lab No.*	*COC No.*
QC	**TB M06**	95TCM006TB	07/14/95 1930	BTEX	95TCM006TB	5
	TB M07	95TCM007TB	07/15/95 1900	VOC, GRO	95TCM007TB	6
	TB M08	95TCM008TB	07/16/95 1900	VOC, GRO	95TCM008TB	6
	TB M09	95TCM009TB	07/17/95 1900	VOC, GRO	95TCM009TB	7
	TB M10	95TCM010TB	07/18/95 1900	BTEX, GRO	95TCM010TB	8
	TB M11	95TCM011TB	07/19/95 1900	VOC, GRO	95TCM011TB	11
	TB M12	95TCM012TB	07/19/95 2000	BTEX	95TCM012TB	12
ST 12a	**SB C1**	95TCC001SB0.5	07/16/95 1600	PID	FLDC001SB0	0
	SB C4	95TCC004SB7.0	07/14/95 1630	PID	FLDC004SB7	0
ST 12b	**SB D2**	95TCD002SB4.0	07/16/95 1830	PID	FLDD002SB4	0
	SB D3	95TCD003SB1.5	07/17/95 1030	PID	FLDD003SB1	0
		95TCD003SB2.0	07/17/95 1030	PID	FLDD003SB2	0
SS 14a	**SB E6**	95TCE006SB4.0	07/15/95 1640	PID	FLDE006SB4	0
SS 14b	**SB F3**	95TCF003SB10.0	07/16/95 1330	PID	FLDF003SB1	0
	SB F4	95TCF004SB10.0	07/15/95 1950	PID	FLDF004SB1	0
		95TCF004SB16.0	07/16/95 945	PID	FLDF004SB1	0
		95TCF004SB4.5	07/15/95 1850	VOC, PID	FLDF004SB4	0
		95TCF004SB6.5	07/15/95 1910	VOC, PID	FLDF004SB6	0
ST 12c	**SB J2**	95TCJ002SB2.5	07/11/95 1400	PID	FLDJ002SB2	0
	SB J4	95TCJ004SB03.5	07/18/95 1145	PID	FLDJ004SB0	0
	SB J5	95TCJ005SB01.5	07/18/95 1035	PID	FLDJ005SB0	0
		95TCJ005SB01.5	07/18/95 1035	PID	FLDJ005SB0	0
	SB J6	95TCJ006SB4.0	07/18/95 1300	PID	FLDJ006SB4	0
	SB J7	95TCJ007SB1.5	07/18/95 1430	PID	FLDJ007SB1	0
		95TCJ007SB3.0	07/18/95 1440	PID	FLDJ007SB3	0

Table 3-1
Previously Documented Background Conditions
Tin City LRRS

	Surface Soil	Subsurface Soil	Creek Sediment	Ocean Sediment
Sample Location	Cape Creek Road	Cape Creek Road	Lagoon Creek	Bering Sea
Sample ID #	TC-K005-A-7036	TC-S025-A-7038	TC-E002-A-4014	TC-E002-A-4015
Depth	0.5	2.5	0.2	0.2
Metals (mg/kg)				
Aluminum	9,720	5,960	18,400	929
Antimony	5	10.9	4.6	9.1
Arsenic	9.1	5.9	9.3	3
Barium	64	54.2	105	9.1
Beryllium	1.5	1.2	0.73	0.66
Cadmium	1.4	1.6	0.55	1.1
Calcium	146,000	236,000	3,720	245,000
Chromium	29.9	17.4	34.8	2.8
Cobalt	4.6	2.8	23.4	2.1
Copper	10.4	7.2	23.4	1.6
Iron	13,400	8,810	46,200	3,530
Lead	5	2.7	10.7	1.7
Magnesium	73,400	57,300	9,380	128,000
Manganese	86.6	404	1320	125
Mercury	0.15	0.11	0.11	0.12
Nickel	23.2	15	45.6	6.8
Potassium	742	776	1,190	416
Selenium	1.3	0.47	1.2	0.69
Silver	1.5	2.4	1.4	2.7
Sodium	653	439	535	607
Thallium	0.62	0.47	0.54	0.53
Vanadium	47.4	25.6	35	7.3
Zinc	80.6	48.5	87.9	19.5
Pesticides & PCBs (ug/kg)				
alpha-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptalchlor epoxide	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
4-4' -DDE	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
Endosulfan III	ND	ND	ND	ND
4,4' -DDD	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
4-4' -DDT	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
Aroclor 1016	ND	ND	ND	34
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	44

Source: WCC, 1993

ND: Not detected
mg/kg: milligrams per kilogram
ug/kg: micrograms per kilogram

TABLE 3-2
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **BKG**

IRP DESCRIPTION: Background

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SS K1	0.0-0.5	Soil/Tundra mat	BTEX, GRO, DRO/RRO, Lead, SVOC, PCBs	TPH, diesel-range	160.0	(22.0)	MG/KG (Dry Weight)	I
				TPH, residual-range	800.0	(280.0)	MG/KG (Dry Weight)	I
				Lead	3.80	(0.48)	MG/KG (Dry Weight)	
				Aroclor-1254	310.000	(180.000)	UG/KG (Dry Weight)	
SS K2	0.0-0.5	Soil/Gravel	GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	TPH, diesel-range	8.1	(4.3)	MG/KG (Dry Weight)	I
				TPH, residual-range	62.0	(53.0)	MG/KG (Dry Weight)	I
				Arsenic	0.72	(0.10)	MG/KG (Dry Weight)	
				Barium	14.60	(1.70)	MG/KG (Dry Weight)	
				Cadmium	0.340	(0.100)	MG/KG (Dry Weight)	
				Chromium	1.30	(0.21)	MG/KG (Dry Weight)	BI
				Lead	4.70	(0.10)	MG/KG (Dry Weight)	
SS K3	0.0-2.0	Soil/Peat	BTEX, GRO, DRO/RRO, Lead, SVOC, PCBs	TPH, diesel-range	55.0	(10.0)	MG/KG (Dry Weight)	I
				TPH, residual-range	360.0	(120.0)	MG/KG (Dry Weight)	I
				Lead	2.80	(0.17)	MG/KG (Dry Weight)	
				Ethylbenzene	12.0	(2.4)	UG/KG (Dry Weight)	
				o-Xylene	19.0	(2.4)	UG/KG (Dry Weight)	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-2
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **BKG**

IRP DESCRIPTION: Background

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SW/SD K2	N/A	Water/Cape Creek	VOC, Metals, SVOC, PEST/PCBs	Arsenic	7.40	(1.00)	UG/L
				Barium	150.00	(17.00)	UG/L
				Chromium	25.80	(2.00)	UG/L
				Lead	9.40	(1.00)	UG/L
				Selenium	2.60	(2.00)	UG/L
SW/SD K3	N/A	Water/Lake	VOC, Metals, SVOC, PEST/PCBs	Lead	1.30	(1.00)	UG/L

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

Table 3-3
Regulatory Benchmark
Tin City LRRS

FEDERAL

	HUMAN HEALTH		ECOLOGICAL	
	Groundwater (ug/l)		Surface Water (ug/l)	Sediment (mg/kg)
Analytes	**MCLs and Drinking Water Standards (1)**	**SMCL (1)**	**Ambient Water Quality Criteria (2)**	**NOAA (3)**
Pesticides/PCBs				
4-4'-DDE	--	--	--	0.016
4-4'-DDD	--	--	--	0.02
4-4'-DDT	--	--	0.001/1.1	0.007
Aroclor 1260	0.5	--	--	0.4
Volatile Organics				
1,2-Dichloroethane	5	--	20,000(a) 118,000(a)	--
Tetrachloroethane	5	--	840(a)/5,280(a)	--
Chlorobenzene	100	--	50(b)/250(b)	--
Benzene	5	--	--/5,300(a)	--
Toluene	1,000	--	--/17,500(a)	--
Ethylbenzene	700	--	--/32,000(a)	--
Total xylenes	10,000	--	--	--
Semivolatile Organics				
Phenanthrene	--	--	6.3(c)/30(c)	13.8
Fluoranthene	--	--	--/3,980(a)	--
Phenol	--	--	2,560(a)/10,200(a)	--
Inorganics				
Aluminum	--	50		--
Antimony	6	--	30/88(c)	25
Arsenic	50	--	190(d)/360(d)	85
Barium	2,000	--	--	--
Beryllium	4	--	5.3(a)/130(a)	--
Cadmium	5	--	1.1/3.9(a)	9
Chromium	50	--	210(e)/1,700	145
Copper	1,300	1,000	12(e)/18(e)	390
Iron	--	300	1,000/--	--
Lead	15	--	3.2(e)/82(e)	110
Manganese	--	50	--	--
Mercury	2	--	0.012/2.4	1.3
Nickel	100	--	160(e)/1,400(e)	50
Selenium	50	--	35/260	--
Silver	50	10	1.2/4.1(e)	2.2
Zinc	5,000	5,000	110(e)/120(e)	270

NOTE: Only analytes with ARARs or TBCs are shown on this table.

ug/l = micrograms per liter
mg/kg = milligrams per kilogram
MCLs = maximum contaminant levels
SMCLs = secondary maximum contaminant levels
ARARs = Applicable or Relevant and Appropriate Requirements
TBCs = Other Criteria To Be Considered

(1) MCLs and drinking water standards extracted from 40 CFR Part 141; SMCLs are extracted from 40 CFR Part 143.
(2) U.S. EPA 1988. EPA 440/5-88-001: concentrations are for water and fish ingestion, freshwater chronic/acute.
(3) National Oceanic and Atmospheric Administration (NOAA) NOS/OMa52. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. Long, ER and Morgan, L.G., 1991.

(a) Lowest Observed Effect Level (LOEL) derived from Water Quality Criteria Summary, USEPA Office of Science and Technology, May 1, 1991 (poster).
(b) Lowest Effect Concentration (LEC), IRIS 45 FR 79318, November 28, 1980.
(c) Proposed criteria.
(d) Concentrations listed for Arsenic III, which is the most conservative concentration available.
(e) Hardness dependent.

Table 3-3
Regulatory Benchmark
Tin City LRRS

	ALASKA STATE			
	HUMAN HEALTH			ECOLOGICAL
	Groundwater (ug/l)	Soil (mg/kg)		Surface Water (ug/l)
Analyte	**Alaska Drinking Water Standards (1)**	**Alaska UST (2)**	**Alaska Non-UST (3)**	**Alaska Water Quality Standards (4)**
Volatile Organics				
Benzene	--	0.1	0.1	--
Total BTEX	--	10	10	10
TPH-gasoline range	--	50	50	Free of oils
TPH-diesel range	--	100	100	Free of oils
Total hydrocarbons	--	--	--	15
Inorganics				
Arsenic	50	--	--	--
Barium	1,000	--	--	--
Cadmium	10	--	--	--
Chromium	50	--	--	--
Copper	1,000	--	--	--
Iron	300	--	--	--
Lead	50	--	--	--
Manganese	50	--	--	--
Mercury	2	--	--	--
Selenium	10	--	--	--
Silver	50	--	--	--
Sodium	250,000	--	--	--
Zinc	5,000	--	--	--

NOTE: Only analytes with ARARs or TBCs are shown on this table.

ug/l = micrograms per liter
mg/kg = milligrams per kilogram
ARARs = Applicable or Relevant and Appropriate Requirements
TBCs = Other Criteria To Be Considered

(1) 18 AAC 80
(2) 18 AAC 78
(3) Alaska Department of Environmental Conservation, Interim Guidance for Non-UST Contaminated Soil Cleanup Levels, Guidance Number 001 Revision No. 1, July 17, 1991.
(4) 18 AAC 70

TABLE 3-4
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **DP 011**

IRP DESCRIPTION: Dump #3 at beach with abandoned drums and machinery

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SW/SD A1	0.0-0.5	Sediment	VOC, GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	TPH, diesel-range	410.0	(59.0)	MG/KG (Dry Weight)	
				TPH, residual-range	1400.0	(74.0)	MG/KG (Dry Weight)	
				Arsenic	3.30	(0.14)	MG/KG (Dry Weight)	
				Barium	12.60	(2.40)	MG/KG (Dry Weight)	
				Cadmium	0.480	(0.140)	MG/KG (Dry Weight)	
				Chromium	5.00	(0.28)	MG/KG (Dry Weight)	
				Lead	15.20	(0.14)	MG/KG (Dry Weight)	
				Selenium	0.34	(0.28)	MG/KG (Dry Weight)	M
	N/A	Water	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	Lead	1.40	(1.00)	UG/L	
SW/SD A2	0.0-0.5	Sediment	VOC, GRO, DRO/RRO, Metals, SVOC, PEST/PCBs	TPH, diesel-range	150.0	(13.0)	MG/KG (Dry Weight)	
				TPH, residual-range	2400.0	(150.0)	MG/KG (Dry Weight)	
				Arsenic	7.50	(0.30)	MG/KG (Dry Weight)	
				Barium	40.80	(5.10)	MG/KG (Dry Weight)	
				Cadmium	1.800	(0.300)	MG/KG (Dry Weight)	
				Chromium	27.40	(0.60)	MG/KG (Dry Weight)	
				Lead	118.00	(0.30)	MG/KG (Dry Weight)	
				Selenium	1.60	(0.60)	MG/KG (Dry Weight)	M
	N/A	Water	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	TPH, diesel-range	210.0	(100.0)	UG/L	
				Lead	1.50	(1.00)	UG/L	
SW/SD A3	0.0-0.5	Sediment	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	TPH, diesel-range	60.0	(5.6)	MG/KG (Dry Weight)	
				TPH, residual-range	16000.0	(3500.0)	MG/KG (Dry Weight)	
				Arsenic	3.90	(0.14)	MG/KG (Dry Weight)	
				Barium	13.20	(2.30)	MG/KG (Dry Weight)	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-4
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **DP 011**

IRP DESCRIPTION: Dump #3 at beach with abandoned drums and machinery

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SW/SD A3	0.0-0.5	Sediment	VOC, GRO, DRO, Metals, SVOC, PEST/PCBs	Cadmium	1.700	(0.140)	MG/KG (Dry Weight)
				Chromium	5.10	(0.27)	MG/KG (Dry Weight)
				Lead	28.00	(0.14)	MG/KG (Dry Weight)
				Pyrene	820.0	(460.0)	UG/KG (Dry Weight) J
	N/A	Water		Arsenic	1.40	(1.00)	UG/L
		Water/Duplicate		Chromium	6.00	(2.00)	UG/L
		Water		Lead	1.70	(1.00)	UG/L
				Selenium	4.60	(2.00)	UG/L

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-5
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **AOC 1**

IRP DESCRIPTION: Spill/leak #5 at fuel pumphouse at Bldg. 123

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SB B1	0.0-0.5	Soil	BTEX, GRO, DRO, SVOC	TPH, diesel-range	5700.0	(440.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	120000.0	(5500.0)	UG/KG (Dry Weight)	G
				Ethylbenzene	11.0	(1.1)	UG/KG (Dry Weight)	
				m-Xylene + p-Xylene	4.4	(1.1)	UG/KG (Dry Weight)	
				o-Xylene	17.0	(1.1)	UG/KG (Dry Weight)	
SB B2	0.5-1.0	Soil	BTEX, GRO, DRO, SVOC	TPH, diesel-range	1900.0	(450.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	7500.0	(5600.0)	UG/KG (Dry Weight)	G
				m-Xylene + p-Xylene	4.8	(1.1)	UG/KG (Dry Weight)	
				o-Xylene	3.7	(1.1)	UG/KG (Dry Weight)	
				bis(2-Ethylhexyl) phthalate	380.0	(370.0)	UG/KG (Dry Weight)	J
SB B3	0.5-1.0	Soil	BTEX, GRO, DRO, SVOC	TPH, diesel-range	44.0	(4.0)	MG/KG (Dry Weight)	
				m-Xylene + p-Xylene	2.3	(1.1)	UG/KG (Dry Weight)	
SB B4	0.5-1.0	Soil	BTEX, GRO, DRO, SVOC	TPH, diesel-range	8600.0	(860.0)	MG/KG (Dry Weight)	
SB B5	0.5-1.0	Soil	BTEX, GRO, DRO/RRO, Lead, SVOC	TPH, diesel-range	2900.0	(440.0)	MG/KG (Dry Weight)	
				TPH, residual-range	330.0	(55.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	15000.0	(5500.0)	UG/KG (Dry Weight)	G
				Lead	2.10	(0.09)	MG/KG (Dry Weight)	
				Ethylbenzene	1.8	(1.1)	UG/KG (Dry Weight)	
				m-Xylene + p-Xylene	6.5	(1.1)	UG/KG (Dry Weight)	
				o-Xylene	3.2	(1.1)	UG/KG (Dry Weight)	
SB B6	0.2-0.6	Soil	BTEX, GRO, DRO/RRO, Lead, SVOC	TPH, diesel-range	830.0	(450.0)	MG/KG (Dry Weight)	
				TPH, residual-range	66.0	(56.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	97000.0	(5600.0)	UG/KG (Dry Weight)	G

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-5
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: AOC 1

IRP DESCRIPTION: Spill/leak #5 at fuel pumphouse at Bldg. 123

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB B6	0.2-0.6	Soil	BTEX, GRO, DRO/RRO, Lead, SVOC	Lead	5.10	(0.08)	MG/KG (Dry Weight)
				Ethylbenzene	14.0	(1.1)	UG/KG (Dry Weight)
				m-Xylene + p-Xylene	5.8	(1.1)	UG/KG (Dry Weight)
				o-Xylene	31.0	(1.1)	UG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-5
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **AOC 1**

IRP DESCRIPTION: Spill/leak #5 at fuel pumphouse at Bldg. 123

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SW/SD B1	0.0-0.1	Sediment	GRO, DRO/RRO, Lead, SVOC	TPH, diesel-range	160.0	(51.0)	MG/KG (Dry Weight)
				TPH, residual-range	160.0	(63.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	95000.0	(6500.0)	UG/KG (Dry Weight) G
				Lead	7.30	(0.12)	MG/KG (Dry Weight)
	N/A	Water	BTEX, GRO, DRO, Lead, SVOC	TPH, diesel-range	9000.0	(1000.0)	UG/L
				Lead	468.00	(1.00)	UG/L
SW/SD B2	N/A	Water	BTEX, GRO, DRO, Lead, SVOC	TPH, diesel-range	1800.0	(100.0)	UG/L
				Lead	5.10	(1.00)	UG/L
				m-Xylene + p-Xylene	1.6	(1.0)	UG/L
				o-Xylene	1.8	(1.0)	UG/L

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-6
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12a**

IRP DESCRIPTION: UST #3 (removed) at Power Plant (Bldg. 110)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB C1	0.0-0.5	Soil	PID	Organic Vapors	43.3	(1.0)	Meter Units
	4.0-6.0		BTEX, DRO, PID	TPH, diesel-range	14.0	(4.0)	MG/KG (Dry Weight)
				Organic Vapors	11.2	(1.0)	Meter Units
SB C2	4.0-4.5	Soil	BTEX, GRO, DRO, SVOC, PID	TPH, diesel-range	1100.0	(43.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	8600.0	(5000.0)	UG/KG (Dry Weight)
				Organic Vapors	270.0	(1.0)	Meter Units
				Ethylbenzene	17.0	(1.0)	UG/KG (Dry Weight)
				m-Xylene + p-Xylene	1.8	(1.0)	UG/KG (Dry Weight)
				o-Xylene	35.0	(1.0)	UG/KG (Dry Weight)
	6.0-7.5			TPH, diesel-range	570.0	(49.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	11000.0	(5500.0)	UG/KG (Dry Weight)
				Organic Vapors	582.0	(1.0)	Meter Units
				o-Xylene	16.0	(1.1)	UG/KG (Dry Weight)
SB C3	4.0-6.0	Soil	BTEX, GRO, DRO, SVOC, PID	TPH, diesel-range	10.0	(4.2)	MG/KG (Dry Weight)
				Organic Vapors	175.0	(1.0)	Meter Units
SB C4	2.0-4.0	Soil	BTEX, GRO, DRO, PID	TPH, diesel-range	3500.0	(430.0)	MG/KG (Dry Weight)
				Organic Vapors	220.0	(1.0)	Meter Units
	4.0-6.0		PID	Organic Vapors	1430.0	(1.0)	Meter Units
	4.5-5.5		BTEX, DRO/RRO, PID	TPH, diesel-range	2300.0	(410.0)	MG/KG (Dry Weight)
				Organic Vapors	1430.0	(1.0)	Meter Units
				Ethylbenzene	60.0	(1.0)	UG/KG (Dry Weight)
				Toluene	5.2	(1.0)	UG/KG (Dry Weight)
				m-Xylene + p-Xylene	6.1	(1.0)	UG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-6
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12a**

IRP DESCRIPTION: UST #3 (removed) at Power Plant (Bldg. 110)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB C4	4.5-5.5	Soil	BTEX, DRO/RRO, PID	o-Xylene	71.0	(1.0)	UG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-7
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12b**

IRP DESCRIPTION: UST #20 (removed) at Composite Building (Bldg. 150)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB D1	1.0-2.0	Soil	VOC, GRO, DRO/RRO, SVOC, PID	TPH, diesel-range	97.0	(4.0)	MG/KG (Dry Weight)
				TPH, residual-range	390.0	(55.0)	MG/KG (Dry Weight)
				Organic Vapors	13.2	(1.0)	Meter Units
	3.0-4.0		VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol, PID	TPH, diesel-range	70.0	(4.0)	MG/KG (Dry Weight)
				TPH, residual-range	130.0	(50.0)	MG/KG (Dry Weight)
				Organic Vapors	42.0	(1.0)	Meter Units
				Arsenic	0.78	(0.10)	MG/KG (Dry Weight)
				Barium	8.30	(1.60)	MG/KG (Dry Weight)
				Cadmium	0.340	(0.096)	MG/KG (Dry Weight)
				Chromium	17.70	(0.19)	MG/KG (Dry Weight)
				Lead	2.10	(0.10)	MG/KG (Dry Weight)
SB D2	2.0-3.5	Soil	VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol, PID	TPH, diesel-range	120.0	(42.0)	MG/KG (Dry Weight)
				TPH, residual-range	430.0	(53.0)	MG/KG (Dry Weight)
				Organic Vapors	21.4	(1.0)	Meter Units
				Arsenic	3.10	(0.10)	MG/KG (Dry Weight)
				Barium	20.00	(1.70)	MG/KG (Dry Weight)
				Cadmium	0.510	(0.098)	MG/KG (Dry Weight)
				Chromium	4.30	(0.19)	MG/KG (Dry Weight)
				Lead	6.00	(0.10)	MG/KG (Dry Weight)
	3.5-4.5		PID	Organic Vapors	20.0	(1.0)	Meter Units
SB D3	0.0-1.5	Soil	PID	Organic Vapors	139.0	(1.0)	Meter Units
	1.0-2.0			Organic Vapors	28.3	(1.0)	Meter Units
	3.0-5.0		VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol, PID	TPH, diesel-range	42.0	(4.0)	MG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-7
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12b**

IRP DESCRIPTION: UST #20 (removed) at Composite Building (Bldg. 150)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB D3	3.0-5.0	Soil	VOC, GRO, DRO/RRO, Metals, SVOC, E.Glycol, PID	TPH, gasoline-range	7300.0	(5200.0)	UG/KG (Dry Weight)
				Organic Vapors	57.4	(1.0)	Meter Units
				Arsenic	1.40	(0.10)	MG/KG (Dry Weight)
				Barium	12.50	(1.70)	MG/KG (Dry Weight)
				Cadmium	0.680	(0.100)	MG/KG (Dry Weight)
				Chromium	3.20	(0.20)	MG/KG (Dry Weight)
				Lead	2.00	(0.10)	MG/KG (Dry Weight)
	6.0-7.0		VOC, GRO, DRO/RRO, SVOC, PID	TPH, diesel-range	15.0	(4.0)	MG/KG (Dry Weight)
				Organic Vapors	20.3	(1.0)	Meter Units

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-8
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: SS 13a

IRP DESCRIPTION: Stained soils from spill/leak #3 at lower tram (not including AST)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SB G1	0.5-1.0	Soil	VOC, GRO, DRO/RRO, SVOC	TPH, diesel-range	2900.0	(420.0)	MG/KG (Dry Weight)	
				TPH, residual-range	580.0	(53.0)	MG/KG (Dry Weight)	
			PID	Organic Vapors	576.0	(1.0)	Meter Units	
			VOC, GRO, DRO/RRO, SVOC	1,3,5-Trimethylbenzene	10.0	(5.0)	UG/KG (Dry Weight)	J
				bis(2-Ethylhexyl) phthalate	1900.0	(350.0)	UG/KG (Dry Weight)	
SB G2	0.5-2.5	Soil	VOC, GRO, DRO/RRO, Metals, SVOC, PID	TPH, diesel-range	3200.0	(440.0)	MG/KG (Dry Weight)	
				TPH, residual-range	320.0	(56.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	35000.0	(5600.0)	UG/KG (Dry Weight)	
				Organic Vapors	306.0	(1.0)	Meter Units	
				Arsenic	2.10	(0.10)	MG/KG (Dry Weight)	
				Barium	22.70	(1.70)	MG/KG (Dry Weight)	
				Cadmium	0.800	(0.100)	MG/KG (Dry Weight)	
				Chromium	6.60	(0.21)	MG/KG (Dry Weight)	
				Lead	6.80	(0.10)	MG/KG (Dry Weight)	
				Selenium	0.25	(0.21)	MG/KG (Dry Weight)	M
				1,3,5-Trimethylbenzene	32.0	(28.0)	UG/KG (Dry Weight)	J
				Tetrachloroethene	690.0	(28.0)	UG/KG (Dry Weight)	J
SB G3	1.0-3.0	Soil	VOC, BTEX, GRO, DRO/RRO, Metals, SVOC, PID	TPH, diesel-range	2700.0	(440.0)	MG/KG (Dry Weight)	
				TPH, residual-range	140.0	(55.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	75000.0	(5500.0)	UG/KG (Dry Weight)	G
				Organic Vapors	489.0	(1.0)	Meter Units	
				Arsenic	3.30	(0.10)	MG/KG (Dry Weight)	
				Barium	47.50	(1.80)	MG/KG (Dry Weight)	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-8
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **SS 13a**

IRP DESCRIPTION: Stained soils from spill/leak #3 at lower tram (not including AST)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SB G3	1.0-3.0	Soil	VOC, BTEX, GRO, DRO/RRO, Metals, SVOC, PID	Cadmium	0.690	(0.100)	MG/KG (Dry Weight)	
				Chromium	12.10	(0.21)	MG/KG (Dry Weight)	
				Lead	6.60	(0.10)	MG/KG (Dry Weight)	
				Selenium	0.67	(0.21)	MG/KG (Dry Weight)	M
				Ethylbenzene	16.0	(1.1)	UG/KG (Dry Weight)	
				o-Xylene	6.7	(1.1)	UG/KG (Dry Weight)	
				1,3,5-Trimethylbenzene	610.0	(27.0)	UG/KG (Dry Weight)	
SB G4	0.5-1.5	Soil	BTEX, GRO, DRO, PID	TPH, diesel-range	36.0	(5.0)	MG/KG (Dry Weight)	
				Organic Vapors	22.4	(1.0)	Meter Units	
				o-Xylene	1.4	(1.2)	UG/KG (Dry Weight)	
SB G5	2.5-3.0	Soil	VOC, GRO, DRO/RRO	TPH, diesel-range	57.0	(4.0)	MG/KG (Dry Weight)	
				TPH, residual-range	72.0	(56.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	8700.0	(5600.0)	UG/KG (Dry Weight)	G
			PID	Organic Vapors	62.0	(1.0)	Meter Units	
SB G6	0.5-3.0	Soil	BTEX, GRO, DRO, PID	TPH, diesel-range	13.0	(4.0)	MG/KG (Dry Weight)	
				Organic Vapors	21.2	(1.0)	Meter Units	
SB G7	0.5-3.0	Soil	BTEX, GRO, DRO, PID	TPH, diesel-range	13.0	(4.0)	MG/KG (Dry Weight)	
				Organic Vapors	23.7	(1.0)	Meter Units	
SB G8	0.5-2.0	Soil	VOC, GRO, DRO/RRO, SVOC, PID	TPH, diesel-range	5400.0	(430.0)	MG/KG (Dry Weight)	
				TPH, residual-range	200.0	(54.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	34000.0	(5400.0)	UG/KG (Dry Weight)	
				Organic Vapors	219.0	(1.0)	Meter Units	
	2.0-3.0		VOC, DRO/RRO, PID	TPH, diesel-range	3400.0	(420.0)	MG/KG (Dry Weight)	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-8
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **SS 13a**

IRP DESCRIPTION: Stained soils from spill/leak #3 at lower tram (not including AST)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB G8	2.0-3.0	Soil	VOC, DRO/RRO, PID	TPH, residual-range	94.0	(53.0)	MG/KG (Dry Weight)
				Organic Vapors	169.0	(1.0)	Meter Units

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-8
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **SS 13a**

IRP DESCRIPTION: Stained soils from spill/leak #3 at lower tram (not including AST)

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SS G1	0.0-0.5	Soil	BTEX, DRO	TPH, diesel-range	2300.0	(420.0)	MG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-9
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **SS 14a**

IRP DESCRIPTION: 3 USTs (removed) at SP 4 near Bldg. 76-200

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB E1	1.0-2.5	Soil	BTEX, DRO, PID	TPH, diesel-range	230.0	(42.0)	MG/KG (Dry Weight)
				Organic Vapors	65.0	(1.0)	Meter Units
SB E2	2.0-3.0	Soil	BTEX, DRO, PID	TPH, diesel-range	350.0	(42.0)	MG/KG (Dry Weight)
				Organic Vapors	32.0	(1.0)	Meter Units
SB E3	6.0-7.5	Soil	BTEX, DRO, PID	TPH, diesel-range	9.0	(4.4)	MG/KG (Dry Weight)
				Organic Vapors	64.0	(1.0)	Meter Units
	10.0-11.0			TPH, diesel-range	14.0	(4.6)	MG/KG (Dry Weight)
				Organic Vapors	60.0	(1.0)	Meter Units
SB E4	2.0-3.5	Soil	BTEX, GRO, DRO/RRO, SVOC, PID	TPH, diesel-range	1900.0	(420.0)	MG/KG (Dry Weight)
				TPH, residual-range	360.0	(52.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	13000.0	(5300.0)	UG/KG (Dry Weight) G
				Organic Vapors	260.0	(1.0)	Meter Units
SB E5	2.0-3.5	Soil	BTEX, GRO, DRO, SVOC, PID	TPH, diesel-range	2200.0	(430.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	140000.0	(5400.0)	UG/KG (Dry Weight) G
				Organic Vapors	77.0	(1.0)	Meter Units
				o-Xylene	14.0	(1.1)	UG/KG (Dry Weight)
	4.0-5.0		DRO, PID	TPH, diesel-range	4500.0	(420.0)	MG/KG (Dry Weight)
				Organic Vapors	79.0	(1.0)	Meter Units
SB E6	2.0-4.5	Soil	BTEX, GRO, DRO/RRO, SVOC, PID	TPH, diesel-range	410.0	(43.0)	MG/KG (Dry Weight)
				TPH, residual-range	9900.0	(540.0)	MG/KG (Dry Weight)
				Organic Vapors	62.0	(1.0)	Meter Units
				bis(2-Ethylhexyl) phthalate	630.0	(350.0)	UG/KG (Dry Weight)
	4.0-4.5		PID	Organic Vapors	14.5	(1.0)	Meter Units

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-10
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **SS 14b**

IRP DESCRIPTION: AST#10 (removed) SP 4 near Bldg. 76-200

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SB F1	1.0-2.5	Soil	BTEX, GRO, DRO, Lead, SVOC, PID	TPH, diesel-range	82.0	(4.0)	MG/KG (Dry Weight)	
				Organic Vapors	70.3	(1.0)	Meter Units	
				Lead	3.20	(0.09)	MG/KG (Dry Weight)	
				bis(2-Ethylhexyl) phthalate	680.0	(360.0)	UG/KG (Dry Weight)	
	4.0-5.5		BTEX, GRO, DRO, PID	TPH, diesel-range	38.0	(4.0)	MG/KG (Dry Weight)	
				Organic Vapors	110.0	(1.0)	Meter Units	
SB F2	2.0-4.0	Soil	BTEX, GRO, DRO, PID	TPH, diesel-range	26.0	(4.0)	MG/KG (Dry Weight)	
				Organic Vapors	7.4	(1.0)	Meter Units	
	4.0-6.0			TPH, diesel-range	16.0	(4.0)	MG/KG (Dry Weight)	
				Organic Vapors	7.9	(1.0)	Meter Units	
SB F3	2.0-4.0	Soil	BTEX, GRO, DRO, PID	TPH, diesel-range	130.0	(43.0)	MG/KG (Dry Weight)	
				Organic Vapors	17.0	(1.0)	Meter Units	
	6.0-7.5		BTEX, GRO, DRO, Lead, SVOC, PID	TPH, diesel-range	4300.0	(450.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	2100.0	(57.0)	MG/KG (Dry Weight)	G
				Organic Vapors	2500.0	(1.0)	Meter Units	
				Lead	37.30	(0.10)	MG/KG (Dry Weight)	
				Ethylbenzene	1600.0	(140.0)	UG/KG (Dry Weight)	
				Toluene	940.0	(140.0)	UG/KG (Dry Weight)	
				m-Xylene + p-Xylene	19000.0	(140.0)	UG/KG (Dry Weight)	
				o-Xylene	48000.0	(140.0)	UG/KG (Dry Weight)	
				2-Methylnaphthalene	9700.0	(750.0)	UG/KG (Dry Weight)	M
				Naphthalene	5700.0	(750.0)	UG/KG (Dry Weight)	M
	10.0-10.5		PID	Organic Vapors	339.0	(1.0)	Meter Units	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-10
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **SS 14b**

IRP DESCRIPTION: AST#10 (removed) SP 4 near Bldg. 76-200

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SB F4	2.0-4.0	Soil	VOC, GRO, DRO, PID	TPH, diesel-range	24.0	(4.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	17000.0	(5400.0)	UG/KG (Dry Weight)	
				Organic Vapors	17.0	(1.0)	Meter Units	
	4.0-5.5		VOC, PID	Organic Vapors	17.4	(1.0)	Meter Units	
	6.0-7.0			Organic Vapors	5.8	(1.0)	Meter Units	
	10.0-10.5		PID	Organic Vapors	20.7	(1.0)	Meter Units	
				Organic Vapors	8.1	(1.0)	Meter Units	
	11.0-12.0		VOC, GRO, DRO, Lead, SVOC, PID	TPH, diesel-range	2400.0	(420.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	190000.0	(5200.0)	UG/KG (Dry Weight)	G
				Organic Vapors	1330.0	(1.0)	Meter Units	
				Lead	1.60	(0.10)	MG/KG (Dry Weight)	
				1,2,4-Trimethylbenzene	19000.0	(650.0)	UG/KG (Dry Weight)	M
				1,3,5-Trimethylbenzene	6700.0	(650.0)	UG/KG (Dry Weight)	M
				Naphthalene	5800.0	(650.0)	UG/KG (Dry Weight)	M
				Xylenes, total	1700.0	(650.0)	UG/KG (Dry Weight)	M
				n-Propylbenzene	1200.0	(650.0)	UG/KG (Dry Weight)	M
				p-Isopropyltoluene	5500.0	(650.0)	UG/KG (Dry Weight)	M
				sec-Butylbenzene	2700.0	(650.0)	UG/KG (Dry Weight)	M
				2-Methylnaphthalene	18000.0	(1400.0)	UG/KG (Dry Weight)	M
	16.0-16.5		PID	Organic Vapors	20.7	(1.0)	Meter Units	
				Organic Vapors	8.1	(1.0)	Meter Units	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-11
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: AOC 2

IRP DESCRIPTION: Fuel Tanks

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SS I1	0.0-0.5	Soil	BTEX, GRO, DRO/RRO, Lead, SVOC, PEST/PCBs	TPH, diesel-range	1100.0	(430.0)	MG/KG (Dry Weight)	
				TPH, residual-range	4600.0	(540.0)	MG/KG (Dry Weight)	
				Lead	357.00	(0.10)	MG/KG (Dry Weight)	
				Aroclor-1254	1300.000	(720.000)	UG/KG (Dry Weight)	J
SS I2	0.0-0.5	Soil	BTEX, GRO, DRO/RRO, Lead, SVOC, PEST/PCBs, PID	TPH, diesel-range	31.0	(4.0)	MG/KG (Dry Weight)	
				TPH, residual-range	320.0	(53.0)	MG/KG (Dry Weight)	
			PID	Organic Vapors	28.4	(1.0)	Meter Units	
			BTEX, GRO, DRO/RRO, Lead, SVOC, PEST/PCBs, PID	Organic Vapors	28.4	(1.0)	Meter Units	
				Lead	13.10	(0.07)	MG/KG (Dry Weight)	
				Aroclor-1254	1200.000	(700.000)	UG/KG (Dry Weight)	
				Aroclor-1260	790.000	(700.000)	UG/KG (Dry Weight)	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-12
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: AOC 3

IRP DESCRIPTION: Substation

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SS N1	0.0-0.5	Soil	DRO/RRO, PEST/PCBs	TPH, diesel-range	33.0	(4.3)	MG/KG (Dry Weight)
				TPH, residual-range	150.0	(52.0)	MG/KG (Dry Weight)
				Aroclor-1242	3200.000	(360.000)	UG/KG (Dry Weight)
SS N2	0.0-0.5	Soil	DRO/RRO, PEST/PCBs	TPH, diesel-range	11.0	(4.4)	MG/KG (Dry Weight)
				TPH, residual-range	210.0	(56.0)	MG/KG (Dry Weight)
SS N3	0.0-0.2	Soil	DRO/RRO, PEST/PCBs	TPH, diesel-range	5100.0	(430.0)	MG/KG (Dry Weight)
				TPH, residual-range	140000.0	(5400.0)	MG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-13
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12c**

IRP DESCRIPTION: 4,000 gal. diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SW/SD J1	0.0-0.5	Sediment	BTEX, GRO, DRO/RRO, SVOC, PEST/PCBs	TPH, diesel-range	50.0	(5.2)	MG/KG (Dry Weight)	I
				TPH, residual-range	210.0	(65.0)	MG/KG (Dry Weight)	I
	N/A	Water	BTEX, GRO, DRO, SVOC, PEST/PCBs	TPH, diesel-range	9800.0	(1000.0)	UG/L	
				Diethyl phthalate	20.0	(10.0)	UG/L	
SW/SD J2	0.0-0.5	Sediment	BTEX, GRO, DRO/RRO, SVOC, PEST/PCBs	TPH, diesel-range	2400.0	(890.0)	MG/KG (Dry Weight)	
				TPH, residual-range	1400.0	(110.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	66.0	(11.0)	MG/KG (Dry Weight)	
				Ethylbenzene	98.0	(2.2)	UG/KG (Dry Weight)	
				m-Xylene + p-Xylene	9.0	(2.2)	UG/KG (Dry Weight)	
				o-Xylene	140.0	(2.2)	UG/KG (Dry Weight)	
	N/A	Water	BTEX, GRO, DRO, SVOC, PEST/PCBs	TPH, diesel-range	4300.0	(1000.0)	UG/L	
				m-Xylene + p-Xylene	2.5	(1.0)	UG/L	
				o-Xylene	3.4	(1.0)	UG/L	
				4-Methylphenol	19.0	(10.0)	UG/L	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-13
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12c**

IRP DESCRIPTION: 4,000 gal. diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB J1	0.5-1.0	Soil	BTEX, GRO, DRO, SVOC	TPH, diesel-range	14000.0	(4700.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	66000.0	(5900.0)	UG/KG (Dry Weight)
			PID	Organic Vapors	891.0	(1.0)	Meter Units
			BTEX, GRO, DRO, SVOC	Ethylbenzene	38.0	(1.2)	UG/KG (Dry Weight)
				Toluene	1.3	(1.2)	UG/KG (Dry Weight)
				m-Xylene + p-Xylene	2.4	(1.2)	UG/KG (Dry Weight)
				o-Xylene	40.0	(1.2)	UG/KG (Dry Weight)
SB J2	0.0-0.5	Soil	BTEX, GRO, DRO, SVOC	TPH, diesel-range	14000.0	(4500.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	30000.0	(5600.0)	UG/KG (Dry Weight)
			PID	Organic Vapors	390.0	(1.0)	Meter Units
				Organic Vapors	62.3	(1.0)	Meter Units
			BTEX, GRO, DRO, SVOC	Ethylbenzene	6.1	(1.1)	UG/KG (Dry Weight)
				o-Xylene	6.8	(1.1)	UG/KG (Dry Weight)
SB J3	0.5-1.0	Soil	BTEX, DRO, PID	TPH, diesel-range	5000.0	(480.0)	MG/KG (Dry Weight)
			PID	Organic Vapors	255.0	(1.0)	Meter Units
			BTEX, DRO, PID	Organic Vapors	255.0	(1.0)	Meter Units
				Ethylbenzene	3.0	(1.2)	UG/KG (Dry Weight)
				o-Xylene	16.0	(1.2)	UG/KG (Dry Weight)
SB J4	0.5-3.0	Soil	BTEX, DRO, PID	TPH, diesel-range	12000.0	(910.0)	MG/KG (Dry Weight)
				Organic Vapors	380.0	(1.0)	Meter Units
				Ethylbenzene	150.0	(1.1)	UG/KG (Dry Weight)
				Toluene	17.0	(1.1)	UG/KG (Dry Weight)
				m-Xylene + p-Xylene	310.0	(1.1)	UG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-13
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12c**

IRP DESCRIPTION: 4,000 gal. diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units
SB J4	0.5-3.0	Soil	BTEX, DRO, PID	o-Xylene	250.0	(1.1)	UG/KG (Dry Weight)
	3.0-4.5		PID	Organic Vapors	368.0	(1.0)	Meter Units
SB J5	0.5-2.0	Soil	PID	Organic Vapors	21.0	(1.0)	Meter Units
				Organic Vapors	21.0	(1.0)	Meter Units
				Organic Vapors	27.8	(1.0)	Meter Units
				Organic Vapors	27.8	(1.0)	Meter Units
	2.0-3.5		BTEX, GRO, DRO, SVOC, PID	TPH, diesel-range	130.0	(45.0)	MG/KG (Dry Weight)
				Organic Vapors	175.0	(1.0)	Meter Units
				m-Xylene + p-Xylene	1.2	(1.1)	UG/KG (Dry Weight)
SB J6	0.5-2.5	Soil	BTEX, GRO, DRO, SVOC, PID	TPH, diesel-range	24000.0	(4500.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	590.0	(28.0)	MG/KG (Dry Weight)
				Organic Vapors	880.0	(1.0)	Meter Units
				Ethylbenzene	85.0	(1.1)	UG/KG (Dry Weight)
				o-Xylene	65.0	(1.1)	UG/KG (Dry Weight)
	2.5-4.5		PID	Organic Vapors	1510.0	(1.0)	Meter Units
	5.0-6.0		BTEX, GRO, DRO/RRO, SVOC, PID	TPH, diesel-range	9900.0	(850.0)	MG/KG (Dry Weight)
				TPH, residual-range	210.0	(53.0)	MG/KG (Dry Weight)
				TPH, gasoline-range	590.0	(26.0)	MG/KG (Dry Weight)
				Organic Vapors	218.0	(1.0)	Meter Units
				Ethylbenzene	19000.0	(130.0)	UG/KG (Dry Weight)
				Toluene	4000.0	(130.0)	UG/KG (Dry Weight)
				m-Xylene + p-Xylene	2400.0	(130.0)	UG/KG (Dry Weight)
				o-Xylene	21000.0	(130.0)	UG/KG (Dry Weight)

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-13
TIN CITY LRRS
Detectable Analytical Results Summary

IRP SITE: **ST 12c**

IRP DESCRIPTION: 4,000 gal. diesel fuel tank UST #16 (removed) at Weather Station, Bldg. 132

Location	Depth(ft)	Matrix	List of Analytes	Analyte	Result	MRL	Units	
SB J6	5.0-6.0	Soil	BTEX, GRO, DRO/RRO, SVOC, PID	2-Methylnaphthalene	26000.0	(350.0)	UG/KG (Dry Weight)	J
				Phenanthrene	560.0	(350.0)	UG/KG (Dry Weight)	
SB J7	0.5-2.5	Soil	PID	Organic Vapors	50.2	(1.0)	Meter Units	
	2.5-4.5			Organic Vapors	55.4	(1.0)	Meter Units	
	5.0-6.0		BTEX, GRO, DRO, SVOC, PID	TPH, diesel-range	11000.0	(900.0)	MG/KG (Dry Weight)	
				TPH, gasoline-range	230000.0	(5600.0)	UG/KG (Dry Weight)	
				Organic Vapors	124.0	(1.0)	Meter Units	
				Ethylbenzene	59.0	(1.1)	UG/KG (Dry Weight)	
				m-Xylene + p-Xylene	39.0	(1.1)	UG/KG (Dry Weight)	
				o-Xylene	78.0	(1.1)	UG/KG (Dry Weight)	
				2-Methylnaphthalene	2500.0	(370.0)	UG/KG (Dry Weight)	J
SB J8	0.0-0.5	Soil	BTEX, DRO, PID	TPH, diesel-range	140.0	(44.0)	MG/KG (Dry Weight)	
			PID	Organic Vapors	37.0	(1.0)	Meter Units	
			BTEX, DRO, PID	Organic Vapors	37.0	(1.0)	Meter Units	
SB J9	0.0-0.5	Soil	BTEX, DRO, PID	TPH, diesel-range	18000.0	(4900.0)	MG/KG (Dry Weight)	
			PID	Organic Vapors	242.0	(1.0)	Meter Units	
			BTEX, DRO, PID	Organic Vapors	242.0	(1.0)	Meter Units	
SB J10	0.5-1.0	Soil	BTEX, GRO, DRO, SVOC	TPH, diesel-range	75.0	(4.0)	MG/KG (Dry Weight)	

BI = Datum associated with contaminated trip blank or laboratory method blank.
G = Result affected by non-target hydrocarbons (e.g., diesel influence in GRO analysis).
I = Chromatographic pattern associated with result is not recognized.
J = Estimated value; bias unknown.
M = Result influenced by matrix effects.
ND = Not detected.

TABLE 3-14. LIST OF CHEMICALS DETECTED AT THE BEACH (Page 1 of 6)								
	AOC1				DP011			
		Soil				Soil		
Parameter	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Metals								
Aluminum								
Antimony								
Arsenic					■			■
Barium					■			□
Beryllium								
Cadmium					■			□
Calcium								
Chromium, total					■			■
Cobalt								
Copper								
Iron								
Lead	■	■		■	■			■
Magnesium								
Manganese								
Mercury								
Molybdenum								
Nickel								
Potassium								
Selenium					■			■
Silica								
Silver					□			□
Sodium								
Thallium								
Vanadium								
Zinc								

KEY

Blank = Not Analyzed　　□ Not Detected　　■ Detected

SW = Surface Water　　Sed = Sediment

TABLE 3-14. LIST OF CHEMICALS DETECTED AT THE BEACH (Page 2 of 6)								
	AOC1				DP011			
		Soil				Soil		
Parameter	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Pesticides/PCBs								
4,4'-DDD					☐			☐
4,4'-DDE					☐			☐
4,4'-DDT					☐			☐
Aroclor 1016					☐			☐
Aroclor 1221					☐			☐
Aroclor 1232					☐			☐
Aroclor 1242					☐			☐
Aroclor 1248					☐			☐
Aroclor 1254					☐			☐
Aroclor 1260					☐			☐
Chlordane, technical					☐			☐
Dieldrin					☐			☐
Endosulfan I					☐			☐
Endosulfan II					☐			☐
Endosulfan Sulfate					☐			☐
Endrin					☐			☐
Endrin Aldehyde					☐			☐
Heptachlor					☐			☐
Heptachlor Epoxide					☐			☐
Methoxychlor					☐			☐
Toxaphene					☐			☐
alpha-BHC					☐			☐
beta-BHC					☐			☐
delta-BHC					☐			☐
gamma-BHC					☐			☐

TABLE 3-14. LIST OF CHEMICALS DETECTED AT THE BEACH (Page 3 of 6)								
	AOC1				DP011			
		Soil				Soil		
Parameter	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Volatile Organics								
1,1,1,2-Tetrachloroethane					□			□
1,1,1-Trichloroethane					□			□
1,1,2,2-Tetrachloroethane					□			□
1,1,2-Trichloroethane					□			□
1,1-Dichloroethane					□			□
1,1-Dichloroethene					□			□
1,1-Dichloropropene					□			□
1,2,3-Trichlorobenzene					□			□
1,2,3-Trichloropropane					□			□
1,2,4-Trichlorobenzene					□			□
1,2,4-Trimethylbenzene					□			□
1,2-Dibromo-3-chloropropane					□			□
1,2-Dibromoethane					□			□
1,2-Dichlorobenzene					□			□
1,2-Dichloroethane					□			□
1,2-Dichloropropane					□			□
1,3,5-Trimethylbenzene					□			□
1,3-Dichlorobenzene					□			□
1,3-Dichloropropane					□			□
1,4-Dichlorobenzene					□			□
1-Chlorohexane					□			□
2,2-Dichloropropane					□			□
2-Chlorotoluene					□			□
4-Chlorotoluene					□			□
Benzene		□		□	□			□
Bromobenzene					□			□
Bromochloromethane					□			□
Bromodichloromethane					□			□
Bromoform					□			□
Bromomethane					□			□
Carbon tetrachloride					□			□
Chlorobenzene					□			□
Chloroethane					□			□
Chloroform					□			□
Chloromethane					□			□
Dibromochloromethane					□			□
Dibromomethane					□			□
Dichlorodifluoromethane					□			□
Ethylbenzene		■		□	□			□
Hexachlorobutadiene					□			□
Isopropylbenzene					□			□
Methylene chloride					□			□
Naphthalene					□			□
Naphthalene					□			□
Naphthalene					□			□
Styrene					□			□
Tetrachloroethene					□			□
Toluene		□		□	□			□
Trichloroethene					□			□
Trichlorofluoromethane					□			□
Vinyl chloride					□			□

TABLE 3-14. LIST OF CHEMICALS DETECTED AT THE BEACH
(Page 4 of 6)

Parameter	AOC1				DP011			
		Soil				Soil		
	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Volatile Organics (Cont.)								
Xylenes, total		■		■	□			■
m-Xylene + p-Xylene		■		■	□			■
o-Xylene		■		■	□			■
cis-1,2-Dichloroethene					□			□
cis-1,3-Dichloropropene					□			□
n-Butylbenzene					□			□
n-Propylbenzene					□			□
p-Isopropyltoluene					□			□
sec-Butylbenzene					□			□
tert-Butylbenzene					□			□
trans-1,2-Dichloroethene					□			□
trans-1,3-Dichlorpropene					□			□
Semivolatile Organics								
1,2,4-Trichlorobenzene	□	□		□	□			□
1,2-Dichlorobenzene	□	□		□	□			□
1,3-Dichlorobenzene	□	□		□	□			□
1,4-Dichlorobenzene	□	□		□	□			□
2,2'-oxybis (1-Chloropropane)	□	□		□	□			□
2,4,5-Trichlorophenol	□	□		□	□			□
2,4,6-Trichlorophenol	□	□		□	□			□
2,4-Dichlorophenol	□	□		□	□			□
2,4-Dimethylphenol	□	□		□	□			□
2,4-Dinitrophenol	□	□		□	□			□
2,4-Dinitrotoluene	□	□		□	□			□
2,6-Dinitrotoluene	□	□		□	□			□
2-Chloronaphthalene	□	□		□	□			□
2-Chlorophenol	□	□		□	□			□
2-Methyl-4,6-dinitrophenol	□	□		□	□			□
2-Methylnaphthalene	□	□		□	□			□
2-Methylphenol	□	□		□	□			□
2-Nitroaniline	□	□		□	□			□

TABLE 3-14. LIST OF CHEMICALS DETECTED AT THE BEACH (Page 5 of 6)								
	AOC1				DP011			
		Soil				Soil		
Parameter	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Semivolatile Organics (Cont.)								
2-Nitrophenol	□	□		□	□			□
3,3'-Dichlorobenzidine	□	□		□	□			□
3-Nitroaniline	□	□		□	□			□
4-Bromophenyl phenyl ether	□	□		□	□			□
4-Chloro-3-methylphenol	□	□		□	□			□
4-Chloroaniline	□	□		□	□			□
4-Chlorophenyl phenyl ether	□	□		□	□			□
4-Methylphenol	□	□		□	□			□
4-Nitroaniline	□	□		□	□			□
4-Nitrophenol	□	□		□	□			□
Acenaphthene	□	□		□	□			□
Acenaphthylene	□	□		□	□			□
Anthracene	□	□		□	□			□
Benz[a]anthracene	□	□		□	□			□
Benzo[a]pyrene	□	□		□	□			□
Benzo[b]fluoranthene	□	□		□	□			□
Benzo[g,h,i]perylene	□	□		□	□			□
Benzo[k]fluoranthene	□	□		□	□			□
Benzoic acid	□	□		□	□			□
Benzyl alcohol	□	□		□	□			□
Benzyl butyl phthalate	□	□		□	□			□
Chrysene	□	□		□	□			□
Di-n-butyl phthalate	□	□		□	□			□
Di-n-octyl phthalate	□	□		□	□			□
Dibenz[a,h]anthracene	□	□		□	□			□
Dibenzofuran	□	□		□	□			□
Diethyl phthalate	□	□		□	□			□
Dimethyl phthalate	□	□		□	□			□
Fluoranthene	□	□		□	□			□

TABLE 3-14. LIST OF CHEMICALS DETECTED AT THE BEACH
(Page 6 of 6)

Parameter	AOC1				DP011			
	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW
Semivolatile Organics (Cont.)								
Fluorene	□	□			□			
Hexachlorobenzene	□	□			□			
Hexachlorobutadiene	□	□			□			
Hexachlorocyclopentadiene	□	□			□			
Hexachloroethane	□	□			□			
Indeno(1,2,3-c,d)pyrene	□	□			□			
Isophorone	□	□			□			
N-Nitrosodi-n-propylamine	□	□			□			
N-Nitrosodiphenylamine	□	■			□			
Naphthalene	□	□			□			
Nitrobenzene	□	□			□			
Pentachlorophenol	□	□			□			
Phenanthrene	□	□			□			
Phenol	□	□			□			
Pyrene	□	□			■			
bis(2-Chloroethoxy)methane	□	□			□			
bis(2-Chloroethyl)ether	□	□			□			
bis(2-Ethylhexyl) phthalate	□	■			□			
Miscellaneous								
Organic Vapors								
TPH, gasoline-range		■		□	■			
TPH, residual-range		■			■			
TPH, diesel-range		■		■	■			■
Ethylene glycol								

TABLE 3-15. LIST OF CHEMICALS DETECTED IN LOWER CAMP, TRAMWAY, AND TOP CAMP
(Page 1 of 6)

Parameter	ST12a				ST12b				SS13a				SS13b				SS14a				SS14b				AOC2				AOC3			
		Soil				Soil				Soil				Soil				Soil				Soil				Soil				Soil		
	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Metals																																
Aluminum																																
Antimony																																
Arsenic							■				■																					
Barium							■				■																					
Beryllium																																
Cadmium							■				■																					
Calcium																																
Chromium, total							■				■																					
Cobalt																																
Copper																																
Iron																																
Lead							■				■												■			■						
Magnesium																																
Manganese																																
Mercury							□				□																					
Molybdenum																																
Nickel																																
Potassium																																
Selenium							□				■																					
Silica																																
Silver							□				□																					
Sodium																																
Thallium																																
Vanadium																																
Zinc																																

KEY

Blank = Not Analyzed　□ Not Detected　■ Detected

SW = Surface Water　Sed = Sediment

TABLE 3-15. LIST OF CHEMICALS DETECTED IN LOWER CAMP, TRAMWAY, AND TOP CAMP
(Page 2 of 6)

Parameter	ST12a				ST12b				SS13a				SS13b				SS14a				SS14b				AOC2				AOC3			
		Soil				Soil				Soil				Soil				Soil				Soil				Soil				Soil		
	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Pesticides/PCBs																																
4,4'-DDD														□												□				□		
4,4'-DDE														□												□				□		
4,4'-DDT														□												□				□		
Aroclor 1016														□												□				□		
Aroclor 1221														□												□				□		
Aroclor 1232														□												□				□		
Aroclor 1242														□												□				■		
Aroclor 1248														□												□				□		
Aroclor 1254														□												■				□		
Aroclor 1260														□												■				□		
Chlordane, technical														□												□				□		
Dieldrin														□												□				□		
Endosulfan I														□												□				□		
Endosulfan II														□												□				□		
Endosulfan Sulfate														□												□				□		
Endrin														□												□				□		
Endrin Aldehyde														□												□				□		
Heptachlor														□												□				□		
Heptachlor Epoxide														□												□				□		
Methoxychlor														□												□				□		
Toxaphene														□												□				□		
alpha-BHC														□												□				□		
beta-BHC														□												□				□		
delta-BHC														□												□				□		
gamma-BHC														□												□				□		

TABLE 3-15. LIST OF CHEMICALS DETECTED IN LOWER CAMP, TRAMWAY, AND TOP CAMP
(Page 3 of 6)

Parameter	ST12a				ST12b				SS13a				SS13b				SS14a				SS14b				AOC2				AOC3			
	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW	Sed	Soil 0-2 ft	Soil >2 ft	SW
Volatile Organics																																
1,1,1,2-Tetrachloroethane						□	□			□	□												□									
1,1,1-Trichloroethane						□	□			□	□												□									
1,1,2,2-Tetrachloroethane						□	□			□	□												□									
1,1,2-Trichloroethane						□	□			□	□												□									
1,1-Dichloroethane						□	□			□	□												□									
1,1-Dichloroethene						□	□			□	□												□									
1,1-Dichloropropene						□	□			□	□												□									
1,2,3-Trichlorobenzene						□	□			□	□												□									
1,2,3-Trichloropropane						□	□			□	□												□									
1,2,4-Trichlorobenzene						□	□			□	□												□									
1,2,4-Trimethylbenzene						□	□			□	□												■									
1,2-Dibromo-3-chloropropane						□	□			□	□												□									
1,2-Dibromoethane						□	□			□	□												□									
1,2-Dichlorobenzene						□	□			□	□												□									
1,2-Dichloroethane						□	□			□	□												□									
1,2-Dichloropropane						□	□			■	■												□									
1,3,5-Trimethylbenzene						□	□			□	□												■									
1,3-Dichlorobenzene						□	□			□	□												□									
1,3-Dichloropropane						□	□			□	□												□									
1,4-Dichlorobenzene						□	□			□	□												□									
1-Chlorohexane						□	□			□	□												□									
2,2-Dichloropropane						□	□			□	□												□									
2-Chlorotoluene						□	□			□	□												□									
4-Chlorotoluene						□	□			□	□												□									
Benzene			□			□	□			□	□												□			□						
Bromobenzene						□	□			□	□												□									
Bromochloromethane						□	□			□	□												□									
Bromodichloromethane						□	□			□	□												□									
Bromoform						□	□			□	□												□									
Bromomethane						□	□			□	□												□									
Carbon tetrachloride						□	□			□	□												□									
Chlorobenzene						□	□			□	□												□									
Chloroethane						□	□			□	□												□									
Chloroform						□	□			□	□												□									
Chloromethane						□	□			□	□												□									
Dibromochloromethane						□	□			□	□												□									
Dibromomethane						□	□			□	□												□									
Dichlorodifluoromethane						□	□			□	□												□									
Ethylbenzene			■			□	□			□	■												■			□						
Hexachlorobutadiene						□	□			□	□												□									
Isopropylbenzene						□	□			□	□												■									
Methylene chloride						□	□			□	□												□									
Naphthalene						□	□			□	□												■									
Styrene						□	□			□	□												□									
Tetrachloroethene						□	□			□	■												□									
Toluene			■			□	□			□	□												■			□						
Trichloroethene						□	□			□	□												□									
Trichlorofluoromethane						□	□			□	□												□									
Vinyl chloride						□	□			□	□												□									

TABLE 3-15. LIST OF CHEMICALS DETECTED IN LOWER CAMP, TRAMWAY, AND TOP CAMP

	ST12a				ST12b				SS13a				SS13b				SS14a				SS14b				AOC2				AOC3			
		Soil				Soil				Soil				Soil				Soil				Soil				Soil				Soil		
Parameter	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Volatile Organics (Cont.)																																
Xylenes, total			■			□	□			■	■								■				■			■						
m-Xylene + p-Xylene			■			□	□			□	□												■			■						
o-Xylene			■			□	□			■	■								■				■			■						
cis-1,2-Dichloroethene						□	□			□	□												□									
cis-1,3-Dichloropropene						□	□			□	□												□									
n-Butylbenzene						□	□			□	□												□									
n-Propylbenzene						□	□			□	□												■									
p-Isopropyltoluene						□	□			□	■												■									
sec-Butylbenzene						□	□			□	□												■									
tert-Butylbenzene						□	□			□	□												□									
trans-1,2-Dichloroethene						□	□			□	□												□									
trans-1,3-Dichlorpropene						□	□			□	□												□									
Semivolatile Organics																																
1,2,4-Trichlorobenzene			□			□	□			□	□								□				□			□						
1,2-Dichlorobenzene			□			□	□			□	□								□				□			□						
1,3-Dichlorobenzene			□			□	□			□	□								□				□			□						
1,4-Dichlorobenzene			□			□	□			□	□								□				□			□						
2,2'-oxybis (1-Chloropropane)			□			□	□			□	□								□				□			□						
2,4,5-Trichlorophenol			□			□	□			□	□								□				□			□						
2,4,6-Trichlorophenol			□			□	□			□	□								□				□			□						
2,4-Dichlorophenol			□			□	□			□	□								□				□			□						
2,4-Dimethylphenol			□			□	□			□	□								□				□			□						
2,4-Dinitrophenol			□			□	□			□	□								□				□			□						
2,4-Dinitrotoluene			□			□	□			□	□								□				□			□						
2,6-Dinitrotoluene			□			□	□			□	□								□				□			□						
2-Chloronaphthalene			□			□	□			□	□								□				□			□						
2-Chlorophenol			□			□	□			□	□								□				□			□						
2-Methyl-4,6-dinitrophenol			□			□	□			□	□								■				■			■						
2-Methylnaphthalene			□			□	□			□	□								□				□			□						
2-Methylphenol			□			□	□			□	□								□				□			□						
2-Nitroaniline			□			□	□			□	□								□				□			□						

TABLE 3-15. LIST OF CHEMICALS DETECTED IN LOWER CAMP, TRAMWAY, AND TOP CAMP

(Page 5 of 6)

Parameter	ST12a				ST12b				SS13a				SS13b				SS14a				SS14b				AOC2				AOC3			
		Soil				Soil				Soil				Soil				Soil				Soil				Soil				Soil		
	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Semivolatile Organics (Cont.)																																
2-Nitrophenol			□			□	□			□	□								□				□			□						
3,3'-Dichlorobenzidine			□			□	□			□	□								□				□			□						
3-Nitroaniline			□			□	□			□	□								□				□			□						
4-Bromophenyl phenyl ether			□			□	□			□	□								□				□			□						
4-Chloro-3-methylphenol			□			□	□			□	□								□				□			□						
4-Chloroaniline			□			□	□			□	□								□				□			□						
4-Chlorophenyl phenyl ether			□			□	□			□	□								□				□			□						
4-Methylphenol			□			□	□			□	□								□				□			□						
4-Nitroaniline			□			□	□			□	□								□				□			□						
4-Nitrophenol			□			□	□			□	□								□				□			□						
Acenaphthene			□			□	□			□	□								□				□			□						
Acenaphthylene			□			□	□			□	□								□				□			□						
Anthracene			□			□	□			□	□								□				□			□						
Benz[a]anthracene			□			□	□			□	□								□				□			□						
Benzo[a]pyrene			□			□	□			□	□								□				□			□						
Benzo[b]fluoranthene			□			□	□			□	□								□				□			□						
Benzo[g,h,i]perylene			□			□	□			□	□								□				□			□						
Benzo[k]fluoranthene			□			□	□			□	□								□				□			□						
Benzoic acid			□			□	□			□	□								□				□			□						
Benzyl alcohol			□			□	□			□	□								□				□			□						
Benzyl butyl phthalate			□			□	□			□	□								□				□			■						
Chrysene			□			□	□			□	□								□				□			□						
Di-n-butyl phthalate			□			□	□			□	□								□				□			□						
Di-n-octyl phthalate			□			□	□			□	□								□				□			□						
Dibenz[a,h]anthracene			□			□	□			□	□								□				□			□						
Dibenzofuran			□			□	□			□	□								□				□			□						
Diethyl phthalate			□			□	□			□	□								□				□			□						
Dimethyl phthalate			□			□	□			□	□								□				□			□						
Fluoranthene			□			□	□			□	□								□				□			■						

TABLE 3-15. LIST OF CHEMICALS DETECTED IN LOWER CAMP, TRAMWAY. AND TOP CAMP
(Page 6 of 6)

Parameter	ST12a				ST12b				SS13a				SS13b				SS14a				SS14b				AOC2				AOC3			
		Soil				Soil				Soil				Soil				Soil				Soil				Soil				Soil		
	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW	Sed	0-2 ft	>2 ft	SW
Semivolatile Organics (Cont.)																																
Fluorene			□			□	□			□	□								□				■			□						
Hexachlorobenzene			□			□	□			□	□								□				□			□						
Hexachlorobutadiene			□			□	□			□	□								□				□			□						
Hexachlorocyclopentadiene			□			□	□			□	□								□				□			□						
Hexachloroethane			□			□	□			□	□								□				□			□						
Indeno(1,2,3-c,d)pyrene			□			□	□			□	□								□				□			□						
Isophorone			□			□	□			□	□								□				□			□						
N-Nitrosodi-n-propylamine			□			□	□			□	□								□				□			□						
N-Nitrosodiphenylamine			□			□	□			□	□								□				□			□						
Naphthalene			□			□	□			□	□								□				■			□						
Nitrobenzene			□			□	□			□	□								□				□			□						
Pentachlorophenol			□			□	□			□	□								□				□			□						
Phenanthrene			□			□	□			□	□								□				■			■						
Phenol			□			□	□			□	□								□				□			□						
Pyrene			□			□	□			□	□								□				□			■						
bis(2-Chloroethoxy)methane			□			□	□			□	□								□				□			□						
bis(2-Chloroethyl)ether			□			□	□			□	□								□				□			□						
bis(2-Ethylhexyl) phthalate			□			□	□			■	□								■				■			■						
Miscellaneous																																
Organic Vapors		■	■			■	■			■	■								■				■			■						
TPH, gasoline-range			■			□	□			□	■			□					■				□			□						
TPH, residual-range						■	■			■	■								■				□			■				■		
TPH, diesel-range			■			■	■			■	■								■				■			■				■		
Ethylene glycol							□																									

TABLE 3-16. LIST OF CHEMICALS DETECTED AT THE AIRSTRIP
(Page 1 of 6)

Parameter	ST12c			
		Soil		
	Sed	0-2 ft	>2 ft	SW
Metals				
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Cadmium				
Calcium				
Chromium, total				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese				
Mercury				
Molybdenum				
Nickel				
Potassium				
Selenium				
Silica				
Silver				
Sodium				
Thallium				
Vanadium				
Zinc				

KEY

Blank = Not Analyzed ☐ Not Detected ■ Detected

SW = Suface Water Sed = Sediment

TABLE 3-16. LIST OF CHEMICALS DETECTED AT THE AIRSTRIP (Page 2 of 6)				
	ST12c			
		Soil		
Parameter	Sed	0-2 ft	>2 ft	SW
Pesticides/PCBs				
4,4'-DDD	☐			☐
4,4'-DDE	☐			☐
4,4'-DDT	☐			☐
Arochlor 1016	☐			☐
Arochlor 1221	☐			☐
Arochlor 1232	☐			☐
Arochlor 1242	☐			☐
Arochlor 1248	☐			☐
Arochlor 1254	☐			☐
Arochlor 1260	☐			☐
Chlordane, technical	☐			☐
Dieldrin	☐			☐
Endosulfan I	☐			☐
Endosulfan II	☐			☐
Endosulfan Sulfate	☐			☐
Endrin	☐			☐
Endrin Aldehyde	☐			☐
Heptachlor	☐			☐
Heptachlor Epoxide	☐			☐
Methoxychlor	☐			☐
Toxaphene	☐			☐
alpha-BHC	☐			☐
beta-BHC	☐			☐
delta-BHC	☐			☐
gamma-BHC	☐			☐

TABLE 3-16. LIST OF CHEMICALS DETECTED AT THE AIRSTRIP
(Page 3 of 6)

Parameter	ST12c			
		Soil		
	Sed	0-2 ft	>2 ft	SW
Volatile Organics				
1,1,1,2-Tetrachloroethane				
1,1,1-Trichloroethane				
1,1,2,2-Tetrachloroethane				
1,1,2-Trichloroethane				
1,1-Dichloroethane				
1,1-Dichloroethene				
1,1-Dichloropropene				
1,2,3-Trichlorobenzene				
1,2,3-Trichloropropane				
1,2,4-Trichlorobenzene				
1,2,4-Trimethylbenzene				
1,2-Dibromo-3-chloropropane				
1,2-Dibromoethane				
1,2-Dichlorobenzene				
1,2-Dichloroethane				
1,2-Dichloropropane				
1,3,5-Trimethylbenzene				
1,3-Dichlorobenzene				
1,3-Dichloropropane				
1,4-Dichlorobenzene				
1-Chlorohexane				
2,2-Dichloropropane				
2-Chlorotoluene				
4-Chlorotoluene				
Benzene	□	□	■	□
Bromobenzene				
Bromochloromethane				
Bromodichloromethane				
Bromoform				
Bromomethane				
Carbon tetrachloride				
Chlorobenzene				
Chloroethane				
Chloroform				
Chloromethane				
Dibromochloromethane				
Dibromomethane				
Dichlorodifluoromethane				
Ethylbenzene	■	■	■	□
Hexachlorobutadiene				
Isopropylbenzene				
Methylene chloride				
Naphthalene				
Naphthalene				
Naphthalene				
Styrene				
Tetrachloroethene				
Toluene	□	■	■	□
Trichloroethene				
Trichlorofluoromethane				
Vinyl chloride				

TABLE 3-16. LIST OF CHEMICALS DETECTED AT THE AIRSTRIP
(Page 4 of 6)

Parameter	ST12c			
	Sed	Soil 0-2 ft	Soil >2 ft	SW
Volatile Organics (Cont.)				
Xylenes, total	■	■	■	■
m-xylene + p-xylene	■	■	■	■
o-xylene	■	■	■	■
cis-1,2-Dichloroethene				
cis-1,3-Dichloropropene				
n-Butylbenzene				
n-Propylbenzene				
p-Isopropyltoluene				
sec-Butylbenzene				
tert-Butylbenzene				
trans-1,2-Dichloroethene				
trans-1,3-Dichlorpropene				
Semivolatile Organics				
1,2,4-Trichlorobenzene	□	□	□	□
1,2-Dichlorobenzene	□	□	□	□
1,3-Dichlorobenzene	□	□	□	□
1,4-Dichlorobenzene	□	□	□	□
2,2'-oxybis (1-Chloropropane)	□	□	□	□
2,4,5-Trichlorophenol	□	□	□	□
2,4,6-Trichlorophenol	□	□	□	□
2,4-Dichlorophenol	□	□	□	□
2,4-Dimethylphenol	□	□	□	□
2,4-Dinitrophenol	□	□	□	□
2,4-Dinitrotoluene	□	□	□	□
2,6-Dinitrotoluene	□	□	□	□
2-Chloronaphthalene	□	□	□	□
2-Chlorophenol	□	□	□	□
2-Methyl-4,6-dinitrophenol	□	□	□	□
2-Methylnaphthalene	□	□	■	□
2-Methylphenol	□	□	□	□
2-Nitroaniline	□	□	□	□

TABLE 3-16. LIST OF CHEMICALS DETECTED AT THE AIRSTRIP (Page 5 of 6)				
	ST12c			
		Soil		
Parameter	Sed	0-2 ft	>2 ft	SW
Semivolatile Organics (Cont.)				
2-Nitrophenol	□	□	□	□
3,3'-Dichlorobenzidine	□	□	□	□
3-Nitroaniline	□	□	□	□
4-Bromophenyl phenyl ether	□	□	□	□
4-Chloro-3-methylphenol	□	□	□	□
4-Chloroaniline	□	□	□	□
4-Chlorophenyl phenyl ether	□	□	□	□
4-Methylphenol	□	□	□	■
4-Nitroaniline	□	□	□	□
4-Nitrophenol	□	□	□	□
Acenaphthene	□	□	□	□
Acenaphthylene	□	□	□	□
Anthracene	□	□	□	□
Benz[a]anthracene	□	□	□	□
Benzo[a]pyrene	□	□	□	□
Benzo[b]fluoranthene	□	□	□	□
Benzo[g,h,i]perylene	□	□	□	□
Benzo[k]fluoranthene	□	□	□	□
Benzoic acid	□	□	□	□
Benzyl alcohol	□	□	□	□
Benzyl butyl phthalate	□	□	□	□
Chrysene	□	□	□	□
Di-n-butyl phthalate	□	□	□	□
Di-n-octyl phthalate	□	□	□	□
Dibenz[a,h]anthracene	□	□	□	□
Dibenzofuran	□	□	□	□
Diethyl phthalate	□	□	□	■
Dimethyl phthalate	□	□	□	□
Fluoranthene	□	□	□	□

TABLE 3-16. LIST OF CHEMICALS DETECTED AT THE AIRSTRIP

	ST12c			
		Soil		
Parameter	Sed	0-2 ft	>2 ft	SW
Semivolatile Organics (Cont.)				
Fluorene	□	□	□	□
Hexachlorobenzene	□	□	□	□
Hexachlorobutadiene	□	□	□	□
Hexachlorocyclopentadiene	□	□	□	□
Hexachloroethane	□	□	□	□
Indeno(1,2,3-c,d)pyrene	□	□	□	□
Isophorone	□	□	□	□
N-Nitrosodi-n-propylamine	□	□	□	□
N-Nitrosodiphenylamine	□	□	□	□
Naphthalene	□	□	□	□
Nitrobenzene	□	□	□	□
Pentachlorophenol	□	□	□	□
Phenanthrene	□	□	■	□
Phenol	□	□	□	□
Pyrene	□	□	■	□
bis(2-Chloroethoxy)methane	□	□	□	□
bis(2-Chloroethyl)ether	□	□	□	□
bis(2-Ethylhexyl) phthalate	□	□	□	□
Miscellaneous				
Organic Vapors		■	■	
TPH, gasoline-range	■	■	■	□
TPH, residual-range	■		■	
TPH, diesel-range	■	■	■	■
Ethylene glycol				

TABLE 3-17. LIST OF CHEMICALS DETECTED AT BACKGROUND LOCATIONS
(Page 1 of 6)

Parameter	BKG			
		Soil		
	Sed	0-2 ft	>2 ft	SW
Metals				
Aluminum				
Antimony				
Arsenic		■		■
Barium		■		■
Beryllium				
Cadmium		■		
Calcium				
Chromium, total		■		■
Cobalt				
Copper				
Iron				
Lead		■		□
Magnesium				
Manganese				
Mercury		□		□
Molybdenum				
Nickel				
Potassium				
Selenium		□		■
Silica				
Silver		□		□
Sodium				
Thallium				
Vanadium				
Zinc				

KEY

Blank = Not Analyzed □ Not Detected ■ Detected

SW = Surface Water Sed = Sediment

TABLE 3-17. LIST OF CHEMICALS DETECTED AT BACKGROUND LOCATIONS
(Page 2 of 6)

	BKG			
		Soil		
Parameter	Sed	0-2 ft	>2 ft	SW
Pesticides/PCBs				
4,4'-DDD		□		□
4,4'-DDE		□		□
4,4'-DDT		□		□
Arochlor 1016		□		□
Arochlor 1221		□		□
Arochlor 1232		□		□
Arochlor 1242		□		□
Arochlor 1248		□		□
Arochlor 1254		■		□
Arochlor 1260		□		□
Chlordane, technical		□		□
Dieldrin		□		□
Endosulfan I		□		□
Endosulfan II		□		□
Endosulfan Sulfate		□		□
Endrin		□		□
Endrin Aldehyde		□		□
Heptachlor		□		□
Heptachlor Epoxide		□		□
Methoxychlor		□		□
Toxaphene		□		□
alpha-BHC		□		□
beta-BHC		□		□
delta-BHC		□		□
gamma-BHC		□		□

TABLE 3-17. LIST OF CHEMICALS DETECTED AT BACKGROUND LOCATIONS
(Page 3 of 6)

Parameter	BKG			
		Soil		
	Sed	0-2 ft	>2 ft	SW
Volatile Organics				
1,1,1,2-Tetrachloroethane				□
1,1,1-Trichloroethane				□
1,1,2,2-Tetrachloroethane				□
1,1,2-Trichloroethane				□
1,1-Dichloroethane				□
1,1-Dichloroethene				□
1,1-Dichloropropene				□
1,2,3-Trichlorobenzene				□
1,2,3-Trichloropropane				□
1,2,4-Trichlorobenzene				□
1,2,4-Trimethylbenzene				□
1,2-Dibromo-3-chloropropane				□
1,2-Dibromoethane				□
1,2-Dichlorobenzene				□
1,2-Dichloroethane				□
1,2-Dichloropropane				□
1,3,5-Trimethylbenzene				□
1,3-Dichlorobenzene				□
1,3-Dichloropropane				□
1,4-Dichlorobenzene				□
1-Chlorohexane				□
2,2-Dichloropropane				□
2-Chlorotoluene				□
4-Chlorotoluene				□
Benzene		□		□
Bromobenzene				□
Bromochloromethane				□
Bromodichloromethane				□
Bromoform				□
Bromomethane				□
Carbon tetrachloride				□
Chlorobenzene				□
Chloroethane				□
Chloroform				□
Chloromethane				□
Dibromochloromethane				□
Dibromomethane				□
Dichlorodifluoromethane				□
Ethylbenzene		■		□
Hexachlorobutadiene				□
Isopropylbenzene				□
Methylene chloride				□
Naphthalene				□
Naphthalene				□
Naphthalene				□
Styrene				□
Tetrachloroethene				□
Toluene		□		□
Trichloroethene				□
Trichlorofluoromethane				□
Vinyl chloride				□

TABLE 3-17. LIST OF CHEMICALS DETECTED AT BACKGROUND LOCATIONS
(Page 4 of 6)

Parameter	BKG			
		Soil		
	Sed	0-2 ft	>2 ft	SW
Volatile Organics (Cont.)				
Xylenes, total		■		□
m-xylene + p-xylene		□		□
o-xylene		■		□
cis-1,2-Dichloroethene				□
cis-1,3-Dichloropropene				□
n-Butylbenzene				□
n-Propylbenzene				□
p-Isopropyltoluene				□
sec-Butylbenzene				□
tert-Butylbenzene				□
trans-1,2-Dichloroethene				□
trans-1,3-Dichlorpropene				□
Semivolatile Organics				
1,2,4-Trichlorobenzene		□		□
1,2-Dichlorobenzene		□		□
1,3-Dichlorobenzene		□		□
1,4-Dichlorobenzene		□		□
2,2'-oxybis (1-Chloropropane)		□		□
2,4,5-Trichlorophenol		□		□
2,4,6-Trichlorophenol		□		□
2,4-Dichlorophenol		□		□
2,4-Dimethylphenol		□		□
2,4-Dinitrophenol		□		□
2,4-Dinitrotoluene		□		□
2,6-Dinitrotoluene		□		□
2-Chloronaphthalene		□		□
2-Chlorophenol		□		□
2-Methyl-4,6-dinitrophenol		□		□
2-Methylnaphthalene		□		□
2-Methylphenol		□		□
2-Nitroaniline		□		□

TABLE 3-17. LIST OF CHEMICALS DETECTED AT BACKGROUND LOCATIONS (Page 5 of 6)				
	BKG			
		Soil		
Parameter	Sed	0-2 ft	>2 ft	SW
Semivolatile Organics (Cont.)				
2-Nitrophenol		□		□
3,3'-Dichlorobenzidine		□		□
3-Nitroaniline		□		□
4-Bromophenyl phenyl ether		□		□
4-Chloro-3-methylphenol		□		□
4-Chloroaniline		□		□
4-Chlorophenyl phenyl ether		□		□
4-Methylphenol		□		□
4-Nitroaniline		□		□
4-Nitrophenol		□		□
Acenaphthene		□		□
Acenaphthylene		□		□
Anthracene		□		□
Benz[a]anthracene		□		□
Benzo[a]pyrene		□		□
Benzo[b]fluoranthene		□		□
Benzo[g,h,i]perylene		□		□
Benzo[k]fluoranthene		□		□
Benzoic acid		■		□
Benzyl alcohol		□		□
Benzyl butyl phthalate		□		□
Chrysene		□		□
Di-n-butyl phthalate		□		□
Di-n-octyl phthalate		□		□
Dibenz[a,h]anthracene		□		□
Dibenzofuran		□		□
Diethyl phthalate		□		□
Dimethyl phthalate		□		□
Fluoranthene		□		□

TABLE 3-17. LIST OF CHEMICALS DETECTED AT BACKGROUND LOCATIONS (Page 6 of 6)				
	BKG			
		Soil		
Parameter	Sed	0-2 ft	>2 ft	SW
Semivolatile Organics (Cont.)				
Fluorene		□		□
Hexachlorobenzene		□		□
Hexachlorobutadiene		□		□
Hexachlorocyclopentadiene		□		□
Hexachloroethane		□		□
Indeno(1,2,3-c,d)pyrene		□		□
Isophorone		□		□
N-Nitrosodi-n-propylamine		□		□
N-Nitrosodiphenylamine		□		□
Naphthalene		□		□
Nitrobenzene		□		□
Pentachlorophenol		□		□
Phenanthrene		□		□
Phenol		□		□
Pyrene		□		□
bis(2-Chloroethoxy)methane		□		□
bis(2-Chloroethyl)ether		□		□
bis(2-Ethylhexyl) phthalate		■		□
Miscellaneous				
Organic Vapors				
TPH, gasoline-range		□		
TPH, residual-range		■		
TPH, diesel-range		■		
Ethylene glycol				

TABLE 3-18. LIST OF CHEMICALS DETECTED AT DP011b (Page 1 of 5)	
Parameter	Soil 0-2 ft
Pesticides/PCBs	
4,4'-DDD	■
4,4'-DDE	□
4,4'-DDT	□
Aldrin	□
Arochlor 1016	□
Arochlor 1221	□
Arochlor 1232	□
Arochlor 1242	□
Arochlor 1248	□
Arochlor 1254	□
Arochlor 1260	□
Chlordane, alpha	□
Chlordane, bata	□
Dieldrin	□
Endosulfan I	□
Endosulfan II	□
Endosulfan Sulfate	□
Endrin	□
Endrin Aldehyde	□
Heptachlor	□
Heptachlor Epoxide	□
Methoxychlor	□
Toxaphene	□
alpha-BHC	□
beta-BHC	□
delta-BHC	□
gamma-BHC	□

KEY

Blank = Not Analyzed

□ Not Detected

■ Detected

TABLE 3-18. LIST OF CHEMICALS DETECTED AT DP011b (Page 2 of 5)	
Parameter	Soil 0-2 ft
Volatile Organics	
1,1,1,2-Tetrachloroethane	□
1,1,1-Trichloroethane	□
1,1,2,2-Tetrachloroethane	□
1,1,2-Trichloroethane	□
1,1-Dichloroethane	□
1,1-Dichloroethene	□
1,1-Dichloropropene	□
1,2,3-Trichlorobenzene	□
1,2,3-Trichloropropane	□
1,2,4-Trichlorobenzene	□
1,2,4-Trimethylbenzene	□
1,2-Dibromo-3-chloropropane	□
1,2-Dibromoethane	□
1,2-Dichlorobenzene	□
1,2-Dichloroethane	□
1,2-Dichloropropane	□
1,3,5-Trimethylbenzene	■
1,3-Dichlorobenzene	□
1,3-Dichloropropane	□
1,4-Dichlorobenzene	□
1-Chlorohexane	□
2,2-Dichloropropane	□
2-Chlorotoluene	□
4-Chlorotoluene	□
Benzene	□
Bromobenzene	□
Bromochloromethane	□
Bromodichloromethane	□
Bromoform	□
Bromomethane	□
Carbon disulfide	■
Carbon tetrachloride	□
Chlorobenzene	□
Chloroethane	□
Chloroform	□
Chloromethane	□
Dibromochloromethane	□
Dibromomethane	□
Dichlorodifluoromethane	□
Ethylbenzene	□
Hexachlorobutadiene	□
Isopropylbenzene	□
Methylene chloride	■
Naphthalene	□
Naphthalene	□
Naphthalene	□
Styrene	□
Tetrachloroethene	□
Toluene	□
Trichloroethene	□
Trichlorofluoromethane	□
Vinyl chloride	□

TABLE 3-18. LIST OF CHEMICALS DETECTED AT DP011b (Page 3 of 5)	
Parameter	Soil 0-2 ft
Volatile Organics (Cont.)	
Xylenes, total	☐
m-xylene + p-xylene	☐
o-xylene	☐
cis-1,2-Dichloroethene	☐
cis-1,3-Dichloropropene	☐
n-Butylbenzene	☐
n-Propylbenzene	☐
p-Isopropyltoluene	☐
sec-Butylbenzene	☐
tert-Butylbenzene	☐
trans-1,2-Dichloroethene	☐
trans-1,3-Dichlorpropene	☐
Semivolatile Organics	
1,2,4-Trichlorobenzene	☐
1,2-Dichlorobenzene	☐
1,3-Dichlorobenzene	☐
1,4-Dichlorobenzene	☐
2,2'-oxybis (1-Chloropropane)	☐
2,4,5-Trichlorophenol	☐
2,4,6-Trichlorophenol	☐
2,4-Dichlorophenol	☐
2,4-Dimethylphenol	☐
2,4-Dinitrophenol	☐
2,4-Dinitrotoluene	☐
2,6-Dinitrotoluene	☐
2-Chloronaphthalene	☐
2-Chlorophenol	☐
2-Methyl-4,6-dinitrophenol	☐
2-Methylnaphthalene	☐
2-Methylphenol	☐
2-Nitroaniline	☐

TABLE 3-18. LIST OF CHEMICALS DETECTED AT DP011b
(Page 4 of 5)

Parameter	Soil 0-2 ft
Semivolatile Organics (Cont.)	
2-Nitrophenol	□
3,3'-Dichlorobenzidine	□
3-Nitroaniline	□
4-Bromophenyl phenyl ether	□
4-Chloro-3-methylphenol	□
4-Chloroaniline	□
4-Chlorophenyl phenyl ether	□
4-Methylphenol	□
4-Nitroaniline	□
4-Nitrophenol	□
Acenaphthene	□
Acenaphthylene	□
Anthracene	□
Benz[a]anthracene	□
Benzo[a]pyrene	□
Benzo[b]fluoranthene	□
Benzo[g,h,i]perylene	□
Benzo[k]fluoranthene	□
Benzoic acid	□
Benzyl alcohol	□
Benzyl butyl phthalate	□
Chrysene	□
Di-n-butyl phthalate	□
Di-n-octyl phthalate	□
Dibenz[a,h]anthracene	□
Dibenzofuran	□
Diethyl phthalate	□
Dimethyl phthalate	□
Fluoranthene	□

TABLE 3-18. LIST OF CHEMICALS DETECTED AT DP011b (Page 5 of 5)	
Parameter	Soil 0-2 ft
Semivolatile Organics (Cont.)	
Fluorene	☐
Hexachlorobenzene	☐
Hexachlorobutadiene	☐
Hexachlorocyclopentadiene	☐
Hexachloroethane	☐
Indeno(1,2,3-c,d)pyrene	☐
Isophorone	☐
N-Nitrosodi-n-propylamine	☐
N-Nitrosodiphenylamine	☐
Naphthalene	☐
Nitrobenzene	☐
Pentachlorophenol	☐
Phenanthrene	☐
Phenol	☐
Pyrene	☐
bis(2-Chloroethoxy)methane	☐
bis(2-Chloroethyl)ether	☐
bis(2-Ethylhexyl) phthalate	☐

Table 3-19. Risk-based Screening Concentrations for Human Health Baseline Risk Assessment (Page 1 of 3)

Chemical	Surface Water/Ground Water RBC (µg/L)	Endpoint	Source	Soil/Sediment RBC (mg/kg)	Endpoint	Source
Metals						
Antimony	1	NC	1	10	NC	1
Arsenic	0.05	C	1	0.04	C	1
Barium	300	NC	1	2000	NC	1
Beryllium	0.02	C	1	0.01	C	1
Cadmium	2	NC	1	10	NC	1
Chromium, total	20	NC	1			
Copper	100	NC	1	1000	NC	1
Manganese	100	NC	1	3000	NC	1
Mercury	1	NC	1			
Nickel	70	NC	1	500	NC	1
Selenium	20	NC	1	100	NC	1
Silver	20	NC	1	100	NC	1
Thallium	0.3	NC	1	2	NC	1
Vanadium	30	NC	1	200	NC	1
Zinc	1000	NC	1	8000	NC	1
Pesticides/PCBs						
4,4'-DDD	0.3	C	1	0.3	C	1
4,4'-DDE	0.2	C	1	0.2	C	1
4,4'-DDT	0.2	C	1	0.2	C	1
Aldrin	0.005	C	1	0.004	C	1
Aroclor 1016	0.01	C	1	0.008	C	1
Aroclor 1221	0.01	C	1	0.008	C	1
Aroclor 1232	0.01	C	1	0.008	C	1
Aroclor 1242	0.01	C	1	0.008	C	1
Aroclor 1248	0.01	C	1	0.008	C	1
Aroclor 1254	0.01	C	1	0.008	C	1
Aroclor 1260	0.01	C	1	0.008	C	1
Dieldrin	0.005	C	1	0.004	C	1
Endosulfan I	0.2	NC	1	1	NC	1
Endosulfan II	0.2	NC	1	1	NC	1
Endosulfan Sulfate	22	NC	4	8	NC	4
Endirin	1	NC	1	8	NC	1
Heptachlor	0.02	C	1	0.01	C	1
Heptachlor Epoxide	0.009	C	1	0.007	C	1
Methoxychlor	20	NC	1	100	NC	1
Toxaphene	0.08	C	1	0.06	C	1
alpha BHC	0.01	C	1	0.01	C	1
alpha-Chlordane	0.06	C	1	0.05	C	1
beta BHC	0.05	C	1	0.04	C	1
gamma BHC (Lindane)	0.06	C	1	0.05	C	1
gamma-Chlordane	0.06	C	1	0.05	C	1
Semi-volatile organics						
1,2,4-Trichlorobenzene	2	NC	1	300	NC	1
1,2-Dichlorobenzene	50	NC	1	2000	NC	1
1,3-Dichlorobenzene	325	NC	3	114	NC	3
1,4-Dichlorobenzene	3	C	1	3	C	1

Table 3-19. Risk-based Screening Concentrations for Human Health Baseline Risk Assessment (Page 2 of 3)

Chemical	Surface Water/Ground Water RBC (µg/L)	Endpoint	Source	Soil/Sediment RBC (mg/kg)	Endpoint	Source
2,2'-Oxybis (1-Chloropropane)	0.5	C	1	0.9	C	1
2,4,5-Trichlorophenol	400	NC	1	3000	NC	1
2,4,6-Trichlorophenol	2	C	1	5	C	1
2,4-Dichlorophenol	10	NC	1	80	NC	1
2,4-Dimethylphenol	70	NC	1	500	NC	1
2,4-Dinitrophenol	7	NC	1	50	NC	1
2,4-Dinitrotoluene	0.1	C	1	0.09	C	1
2,6-Dinitrotoluene	0.1	C	1	0.09	C	1
2-Chloronaphthalene	300	NC	1	2000	NC	1
2-Chlorophenol	20	NC	1	100	NC	1
2-Methylphenol	200	NC	1	1000	NC	1
2-Nitroaniline	0.2	NC	1	2	NC	1
3,3'-Dichlorobenzidine	0.2	C	1	0.1	C	1
3-Nitroaniline	11	NC	3	4	NC	3
4-Chloroaniline	10	NC	1	100	NC	1
4-Methylphenol	200	NC	1	1000	NC	1
4-Nitroaniline	11	NC	3	4	NC	3
4-Nitrophenol	226	NC	3	80	NC	3
Acenaphthene	200	NC	1	2000	NC	1
Anthracene	1000	NC	1	8000	NC	1
Benzo(a)anthracene	0.01	C	1	0.009	C	1
Benzo(a)pyrene	0.01	C	1	0.009	C	1
Benzo(b)fluoranthene	0.01	C	1	0.009	C	1
Benzo(k)fluoranthene	0.01	C	1	0.009	C	1
Benzoic Acid	10000	NC	1	100000	NC	1
Benzyl Alcohol	1000	NC	1	8000	NC	1
Butylbenzylphthalate	700	NC	1	5000	NC	1
Chrysene	0.01	C	1	0.009	C	1
Dibenzo(a,h) anthracene	0.01	C	1	0.009	C	1
Dibenzofuran	4	NC	1	30	NC	1
Diethyl Phthalate	3000	NC	1	20000	NC	1
Dimethyl Phthalate	40000	NC	1	300000	NC	1
Fluoranthene	100	NC	1	1000	NC	1
Fluorene	100	NC	1	1000	NC	1
Hexachlorobenzene	0.05	C	1	0.04	C	1
Hexachlorobutadiene	1	C	1	0.8	C	1
Hexachlorocyclopentadiene	30	NC	1	200	NC	1
Indeno(1,2,3-c,d)pyrene	0.01	C	1	0.009	C	1
Isophorone	90	C	1	70	C	1
N-Nitrosodi-n-propylamine	0.01	C	1	0.009	C	1
N-Nitrosodiphenylamine	20	C	1	10	C	1
Naphthalene	100	NC	1	1000	NC	1
Pentachlorophenol	0.7	C	1	0.5	C	1
Phenol	2000	NC	1	20000	NC	1
Pyrene	100	NC	1	800	NC	1
bis(2-Chloroethyl) Ether	0.02	C	1	0.05	C	1
bis(2-Ethylhexyl) Phthalate	6	C	1	5	C	1

Table 3-19. Risk-based Screening Concentrations for Human Health Baseline Risk Assessment (Page 3 of 3)

Chemical	Surface Water/Ground Water RBC (µg/L)	Endpoint	Source	Soil/Sediment RBC (mg/kg)	Endpoint	Source
di-n-Octylphthalate	70	NC	1	500	NC	1
di-n-butyl Phthalate	400	NC	1	3000	NC	1
Volatile organics						
1,1,1-Trichloroethane	200	NC	1	2000	NC	1
1,1,2,2-Tetrachloroethane	0.1	C	1	0.3	C	1
1,1,2-Trichloro-1,2,2-trifluoretha	109500	NC	2	38556	NC	1
1,1,2-Trichloroethane	0.4	C	1	1	C	1
1,1-Dichloroethane	100	NC	1	3000	NC	1
1,1-Dichloroethene	0.08	C	1	0.1	C	1
1,2-Dichloroethane	0.3	C	1	0.7	C	1
1,2-Dichloropropane	1	C	1	0.9	C	1
Acetone	400	NC	1	3000	NC	1
Benzene	0.8	C	1	2	C	1
Bromodichloromethane	0.6	C	1	0.5	C	1
Bromoform	10	C	1	8	C	1
Bromomethane	1	NC	1	40	NC	1
Carbon Disulfide	3	NC	1	3000	NC	1
Carbon Tetrachloride	0.3	C	1	0.5	C	1
Chlorobenzene	5	NC	1	500	NC	1
Chloroethane	3000	NC	1			
Chloroform	0.4	C	1	10	C	1
Chloromethane	3	C	1	5	C	1
Dibromochloromethane	1	C	1	0.8	C	1
Ethylbenzene	200	NC	1	3000	NC	1
Hexachloroethane	6	C	1	5	C	1
Methyl Ethyl Ketone (2-butanone)	100	NC	1	1000	NC	1
Methylene Chloride	7	C	1	9	C	1
Nitrobenzene	2	NC	1	10	NC	1
Styrene	2	C	1	2	C	1
Tetrachloroethylene (pce)	2	C	1	1	C	1
Toluene	100	NC	1	5000	NC	1
Trichloroethylene (tce)	3	C	1	5	C	1
Vinyl Acetate	4000	NC	1	30000	NC	1
Vinyl Chloride	0.03	C	1	0.03	C	1
Xylenes, total	80	NC	1	50000	NC	1
cis-1,2-Dichloroethylene	40	NC	1	300	NC	1
cis-1,3-Dichloropropene	0.2	C	1	0.4	C	1
trans-1,2-Dichloroethene	70	NC	1	500	NC	1
trans-1,3-Dichloropropene	0.2	C	1	0.4	C	1

RBC = Risk-based concentration
Endpoints: C = Cancer, NC = Non-cancer
Sources
1 = U.S. EPA (1991c) Supplemental Risk Assessment Guidance
2 = IRIS (U.S. EPA 1994b) using a route to route extrapolation and equation from U.S. EPA (1991c)
3 = U.S. EPA (1994c), Region III Risk Based Concentration Table
4 = HEAST (U.S. EPA 1994a) using RfD for endosulfan and equation from U.S. EPA (1991c)

TABLE 3-20. CHEMICALS OF POTENTIAL CONCERN (COPC) BY MEDIA FOR THE BASELINE HUMAN HEALTH RISK ASSESSMENT, TIN CITY LRRS, ALASKA (Page 1 of 2)

	Media		
Chemical	Sediment	Soil	Surface Water
Metals			
Arsenic	1	1	1
Chromium	4	4	1
Lead	4	4	4
Pesticides/PCBs			
Aldrin	2	2	2
Aroclor 1016	2	2	2
Aroclor 1221	2	2	2
Aroclor 1232	2	2	2
Aroclor 1242	2	1	2
Aroclor 1248	2	2	2
Aroclor 1254	2	1	2
Aroclor 1260	2	1	2
Dieldrin	2	2	2
Heptachlor	2	2	2
Heptachlor Epoxide	2	2	2
Toxaphene	2	2	2
alpha-BHC	2	2	2
beta-BHC		2	
gamma-BHC (Lindane)		2	
alpha-Chlordane	2	2	2
gamma-Chlordane	2	2	2
Semi-volatile Organics			
1,2,4-Trichlorobenzene			2
1,4-Dichlorobenzene		2	2
2,2'-Oxybis(1-chloropropane)			2
2,4,6-Trichlorophenol		2	2
2,4-Dinitrophenol		2	2
2,4-Dinitrotoluene	2	2	2
2,6-Dinitrotoluene	2	2	2
2-Nitroaniline	2	2	2
3,3'-Dichlorobenzidine	2	2	2
3-Nitroaniline		2	2
4-Chloroaniline			2
4-Nitroaniline		2	2
Benzo(a)anthracene	2	2	2
Benzo(a)pyrene	2	2	2
Benzo(b)fluoranthene	2	2	2
Benzo(k)fluoranthene	2	2	2
Chrysene	2	2	2
Dibenzo(a,h)anthracene	2	2	2
Dibenzofuran		2	2
Hexachlorobenzene	2	2	2
Hexachlorobutadiene		2	2
Indeno(1,2,3-c,d)pyrene	2	2	2
N-Nitrosodi-n-propylamine	2	2	2
N-Nitrosodiphenylamine		2	
Pentachlorophenol	2	2	2
bis(2-Chloroethyl)ether	2	2	2

TABLE 3-20. CHEMICALS OF POTENTIAL CONCERN (COPC) BY MEDIA FOR THE BASELINE HUMAN HEALTH RISK ASSESSMENT, TIN CITY LRRS, ALASKA (Page 2 of 2)

Chemical	Media: Sediment	Media: Soil	Media: Surface Water
bis(2-Ethylhexyl)Phthalate		2	2
Volatile Organics			
1,1,2,2-Tetrachloroethane			2
1,1,2-Trichloroethane			2
1,1-Dichloroethene			2
1,2-Dichloroethane			2
1,3,5-Trimethylbenzene		3	
Benzene			2
Bromodichloromethane			2
Carbon tetrachloride			2
Chloroform			2
Vinyl chloride			2
cis-1,3-Dichloropropene			2
trans-1,3-Dichloropropene			2

Key:
1 = Detected concentration exceeded screening value
2 = Practical Quantitation Limit (PQL) exceeded screening value
3 = No screening value available; chemical was detected
4 = No screening value available; metal detected > 3X mean background concentration

Table 3-21. Exposure Point Concentrations (EPC) for Reasonable Maximum Exposure (RME)
Scenario for Chemicals of Potential Concern
Human Health Baseline Risk Assessment (Page 1 of 3)

Media	Chemical	RME (Entire Site)	Conc. Type1	RME (Beach Area)	Conc. Type1	RME (Lower Camp)	Conc. Type1	RME (Airstrip)	Conc. Type1	RME (DP 011b)	Conc. Type1	RME (Background)	Conc. Type1
Sediment	2,4-Dinitrotoluene	0.245	P	0.245	P			0.215	P				
Sediment	2,6-Dinitrotoluene	0.245	P	0.245	P			0.215	P				
Sediment	2-Nitroaniline	1.200	P	1.200	P			1.050	P				
Sediment	3,3'-Dichlorobenzidine	0.485	P	0.485	P			0.430	P				
Sediment	Aldrin	0.006	P	0.006	P			0.001	P				
Sediment	alpha-BHC	0.006	P	0.006	P			0.001	P				
Sediment	alpha-Chlordane	0.006	P	0.006	P			0.001	P				
Sediment	Aroclor 1016	0.120	P	0.120	P			0.022	P				
Sediment	Aroclor 1221	0.245	P	0.245	P			0.044	P				
Sediment	Aroclor 1232	0.120	P	0.120	P			0.022	P				
Sediment	Aroclor 1242	0.120	P	0.120	P			0.022	P				
Sediment	Aroclor 1248	0.120	P	0.120	P			0.022	P				
Sediment	Aroclor 1254	0.120	P	0.120	P			0.022	P				
Sediment	Aroclor 1260	0.120	P	0.120	P			0.022	P				
Sediment	Arsenic	7.500	M	7.500	M								
Sediment	Benzo(a)anthracene	0.245	P	0.245	P			0.215	P				
Sediment	Benzo(a)pyrene	0.245	P	0.245	P			0.215	P				
Sediment	Benzo(b)fluoranthene	0.245	P	0.245	P			0.215	P				
Sediment	Benzo(k)fluoranthene	0.245	P	0.245	P			0.215	P				
Sediment	bis(2-Chloroethyl)ether	0.245	P	0.245	P			0.215	P				
Sediment	Chromium	27.400	M	27.400	M								
Sediment	Chrysene	0.245	P	0.245	P			0.215	P				
Sediment	Dibenzo(a,h)anthracene	0.245	P	0.245	P			0.215	P				
Sediment	Dieldrin	0.012	P	0.012	P			0.002	P				
Sediment	gamma-Chlordane	0.006	P	0.006	P			0.001	P				
Sediment	Heptachlor	0.006	P	0.006	P			0.001	P				
Sediment	Heptachlor Epoxide	0.006	P	0.006	P			0.001	P				
Sediment	Hexachlorobenzene	0.245	P	0.245	P			0.215	P				
Sediment	Indeno(1,2,3-c,d)pyrene	0.245	P	0.245	P			0.215	P				
Sediment	Lead	118.000	M	118.000	M								
Sediment	N-Nitrosodi-n-propylamine	0.245	P	0.245	P			0.215	P				
Sediment	Pentachlorophenol	1.200	P	1.200	P			1.050	P				
Sediment	Toxaphene	0.600	P	0.600	P			0.110	P				
Soil	1,3,5-Trimethylbenzene	0.038	M							0.038	M		
Soil	1,4-Dichlorobenzene	18.500	P							18.500	P		
Soil	2-Nitroaniline	95.000	P							95.000	P		
Soil	3-Nitroaniline	95.000	P							95.000	P		
Soil	4-Nitroaniline	95.000	P							95.000	P		
Soil	2,4,6-Trichlorophenol	18.500	P							18.500	P		
Soil	2,4-Dinitrophenol	95.000	P							95.000	P		
Soil	2,4-Dinitrotoluene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	2,6-Dinitrotoluene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	3,3'-Dichlorobenzidine	37.000	P	0.365	P	0.345	P	0.370	P	37.000	P	0.355	P
Soil	Aldrin	0.095	P			0.018	P			0.095	P	0.001	P
Soil	Aroclor 1016	1.850	P			0.350	P			1.850	P	0.018	P
Soil	Aroclor 1221	3.700	P			0.700	P			3.700	P	0.036	P

Table 3-21. Exposure Point Concentrations (EPC) for Reasonable Maximum Exposure (RME) Scenario for Chemicals of Potential Concern Human Health Baseline Risk Assessment (Page 2 of 3)

Media	Chemical	RME (Entire Site)	Conc. Type1	RME (Beach Area)	Conc. Type1	RME (Lower Camp)	Conc. Type1	RME (Airstrip)	Conc. Type1	RME (DP 011b)	Conc. Type1	RME (Background)	Conc. Type1
Soil	Aroclor 1232	1.850	P			0.350	P			1.850	P	0.018	P
Soil	Aroclor 1242	3.700	M			3.200	M			1.850	P	0.018	P
Soil	Aroclor 1248	1.850	P			0.350	P			1.850	P	0.018	P
Soil	Aroclor 1254	3.700	M			1.300	M			1.850	P	0.310	M
Soil	Aroclor 1260	3.700	M			0.790	M			1.850	P	0.018	P
Soil	Arsenic	0.720	M			0.050	P					0.720	M
Soil	Benzo(a)anthracene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	Benzo(a)pyrene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	Benzo(b)fluoranthene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	Benzo(k)fluoranthene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	bis(2-Chloroethyl)ether	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	bis(2-Ethylhexyl)phthalate	18.500	P							18.500	P		
Soil	Chromium	1.300	M									1.300	M
Soil	Chrysene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	Dibenzo(a,h)anthracene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	Dibenzofuran	18.500	P							18.500	P		
Soil	Dieldrin	0.185	P							0.185	P		
Soil	Heptachlor	0.095	P							0.095	P		
Soil	Heptachlor Epoxide	0.095	P							0.095	P		
Soil	Hexachlorobenzene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	Hexachlorobutadiene	18.500	P							18.500	P		
Soil	Indeno(1,2,3-c,d)pyrene	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	Lead	357.000	M	5.100	M	357.000	M					4.700	M
Soil	N-Nitrosodi-n-propylamine	18.500	P	0.185	P	0.175	P	0.185	P	18.500	P	0.175	P
Soil	N-Nitrosodiphenylamine	18.500	P					18.500	P	18.500	P		
Soil	Pentachlorophenol	95.000	P	0.900	P	0.850	P	0.900	P	95.000	P	0.850	P
Soil	Toxaphene	9.500	P			1.800	P			9.500	P	0.090	P
Soil	alpha-BHC	0.095	P							0.095	P		
Soil	beta-BHC	0.095	P							0.095	P		
Soil	gamma-BHC	0.095	P							0.095	P		
Soil	alpha-Chlordane	0.095	P							0.095	P		
Soil	gamma-Chlordane	0.095	P							0.095	P		
Surface Water	1,1,2,2-Tetrachloroethane	0.500	P	0.500	P							0.500	P
Surface Water	1,1,2-Trichloroethane	0.500	P	0.500	P							0.500	P
Surface Water	1,1-Dichloroethene	0.500	P	0.500	P							0.500	P
Surface Water	1,2,4-Trichlorobenzene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	1,2-Dichloroethane	0.500	P	0.500	P							0.500	P
Surface Water	1,4-Dichlorobenzene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	2,2'-Oxybis(1-chloropropane)	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	2,4,6-Trichlorophenol	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	2,4-Dinitrophenol	25.000	P	25.000	P			25.000	P			5.000	P
Surface Water	2,4-Dinitrotoluene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	2,6-Dinitrotoluene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	2-Nitroaniline	25.000	P	25.000	P			25.000	P			5.000	P
Surface Water	3,3'-Dichlorobenzidine	10.000	P	10.000	P			10.000	P			5.000	P
Surface Water	3-Nitroaniline	25.000	P	25.000	P			25.000	P			5.000	P

Table 3-21. Exposure Point Concentrations (EPC) for Reasonable Maximum Exposure (RME)
Scenario for Chemicals of Potential Concern
Human Health Baseline Risk Assessment (Page 3 of 3)

Media	Chemical	RME (Entire Site)	Conc. Type1	RME (Beach Area)	Conc. Type1	RME (Lower Camp)	Conc. Type1	RME (Airstrip)	Conc. Type1	RME (DP 011b)	Conc. Type1	RME (Background)	Conc. Type1
Surface Water	4-Chloroaniline	10.000	P	10.000	P			10.000	P			5.000	P
Surface Water	4-Nitroaniline	25.000	P	25.000	P			25.000	P			5.000	P
Surface Water	Aldrin	0.125	P	0.013	P			0.125	P			0.013	P
Surface Water	alpha-BHC	0.125	P	0.025	P			0.125	P			0.013	P
Surface Water	alpha-Chlordane	2.500	P	0.250	P			2.500	P			0.250	P
Surface Water	Aroclor 1016	2.500	P	0.250	P			2.500	P			0.250	P
Surface Water	Aroclor 1221	5.000	P	0.500	P			5.000	P			0.500	P
Surface Water	Aroclor 1232	2.500	P	0.500	P			2.500	P			0.250	P
Surface Water	Aroclor 1242	2.500	P	0.250	P			2.500	P			0.250	P
Surface Water	Aroclor 1248	2.500	P	0.250	P			2.500	P			0.250	P
Surface Water	Aroclor 1254	2.500	P	0.250	P			2.500	P			0.250	P
Surface Water	Aroclor 1260	2.500	P	0.250	P			2.500	P			0.250	P
Surface Water	Arsenic	7.400	M	1.400	M							7.400	M
Surface Water	Benzene	0.500	P	0.500	P			0.500	P			0.500	P
Surface Water	Benzo(a)anthracene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Benzo(a)pyrene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Benzo(b)fluoranthene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Benzo(k)fluoranthene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	bis(2-Chloroethyl)ether	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	bis(2-Ethylhexyl)Phthalate	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Bromodichloromethane	0.500	P	0.500	P							0.500	P
Surface Water	Carbon tetrachloride	0.500	P	0.500	P							0.500	P
Surface Water	Chloroform	0.500	P	0.500	P							0.500	P
Surface Water	Chromium	25.800	M	6.000	M							12.900	P
Surface Water	Chrysene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	cis-1,3-Dichloropropene	0.500	P	0.500	P							0.500	P
Surface Water	Dibenzo(a,h)anthracene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Dibenzofuran	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Dieldrin	0.250	P	0.025	P			0.250	P			0.025	P
Surface Water	gamma-Chlordane	2.500	P	0.250	P			2.500	P			0.250	P
Surface Water	Heptachlor	0.125	P	0.013	P			0.125	P			0.013	P
Surface Water	Heptachlor Epoxide	0.125	P	0.013	P			0.125	P			0.013	P
Surface Water	Hexachlorobenzene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Hexachlorobutadiene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Indeno(1,2,3-c,d)pyrene	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Lead	468.000	M	468.000	M							9.400	M
Surface Water	N-Nitrosodi-n-propylamine	5.000	P	5.000	P			5.000	P			5.000	P
Surface Water	Pentachlorophenol	25.000	P	25.000	P			25.000	P				
Surface Water	Toxaphene	12.500	P	1.250	P			12.500	P			1.250	P
Surface Water	trans-1,3-Dichloropropene	0.500	P	0.500	P							0.500	P
Surface Water	Vinyl chloride	0.500	P	0.500	P							0.500	P

All soil and sediment data in mg/kg. Surface water data in ug/L.
Concentration Types:
P = One-half the PQL for Undetected Chemicals Which Exceeded Risk-based Screening Concentrations Based on PQLs
N = 95% UCL
M = Maximum Concentration Reported

TABLE 3-22. VALUES USED IN ASSESSING EXPOSURE AT TIN CITY LRRS (Page 1 of 2)

Parameter	RME Value	Source/Rationale
General Parameters		
Body Weight (BW)		
Adult	70 kg	U.S. EPA, 1990a
Child	15 kg	
Exposure Frequency (EF)	120 days/year	Based upon climatic data from the U.S. Dept. of Commerce Comparative Climatic Data for the United States, 1986
Exposure Duration (ED)		
Adult	18 years	Mean length of residency, based upon 1992 census for Alaska Department of Fish and Wildlife (Fall & Utermohle, 1993)
Child	6 years	
Averaging Time (AT)		
Carcinogen	70 years x 365 days/year	U.S. EPA, 1989
Noncarcinogen	ED x 365 days/year	U.S. EPA, 1989
Pathway Specific Parameters		
Particulate Inhalation		
Inhalation Rate (IR)		
Adult	20 m^3/dav	U.S. EPA, 1991a
Child	12 m^3/day	U.S. EPA Region III, 1994c
Exposure Time (ET)	0.5	Assumes all day exposure, based upon best professional judgment
Soil/Sediment Ingestion		
Soil Ingestion Rate (IR)		
Adult	100 mg/day	U.S. EPA, 1991a
Child	200 mg/day	
Fraction Ingested (FI)	0.005	percent of total area contaminated
Soil./Sediment Dermal Contact		
Skin Surface Area (SS)		
Adult	2,020 cm^2	U.S. EPA, 1992a (Assumes skin exposed includes head and hands)
Child	800 cm^2	
Soil Adherence Factor (AF)	1 mg/cm^2/day	U.S. EPA, 1992a
Absorption Factor (ABS)	Depends on chemical category (%)	U.S. EPA, 1992a

TABLE 3-22. VALUES USED IN ASSESSING EXPOSURE AT TIN CITY LRRS (Page 2 of 2)

Parameter	RME Value	Source/Rationale
Surface Water Dermal Contact		
Skin Surface Area (SS)		
Adult	2,020 cm^2	U.S. EPA, 1992a (Assumes skin exposed includes head and hands)
Child	800 cm^2	
Dermal Permeability Constant (PC)	Chemical Specific (cm/hour)	U.S. EPA, 1992a
Exposure Time (ET)	1.0 hours/day	U.S. EPA, 1992a

TABLE 3-23. ESTIMATED AREAL EXTENT OF SURFACE CONTAMINATION

Area	IRP Sources SVOC/VOC (m^2)	IRP Sources Metals (m^2)	IRP Sources Pesticides/PCBs (m^2)	Background SVOC/VOC (m^2)	Background Metals (m^2)	Background Pesticides/PCBs (m^2)
DP 011a	8366	8366	0	-	-	-
DP 011b	841	0	0	-	-	-
AOC 1	1208	0	0	-	-	-
ST 12a	0	0	0	-	-	-
ST 12b	0	0	0	-	-	-
SS 13a	260	60	0	-	-	-
SS 13b	0	0	0	-	-	-
SS 14a, 14b	604	0	0	-	-	-
AOC 2	1	0	1	-	-	-
AOC 3	0	0	0	-	-	-
ST 12c	1046	0	0	-	-	-
SS K1	-	-	-	0	2	2
SS K2	-	-	-	0	2	0
SS K3	-	-	-	2	2	0
TOTAL	12327	8426	1	2	6	2

TABLE 3-24. ORAL/INHALATION CHRONIC NON-CARCINOGENIC TOXICITY VALUES FOR TIN CITY LRRS
(Page 1 of 2)

	Oral						Inhalation					
Chemical	RfD (mg/kg-day)	Confidence	MF	UF	Critical Effect	Source	RfC (mg/m^3)	Confidence	MF	UF	Critical Effect	Source
1,2,4 Trichlorobenzene	1E-2	Medium	1	100	Increased adrenal weights	IRIS	Pending	-	-	-	-	IRIS
1,1,2 Trichloroethane	4E-3	Medium	1	100	Liver effects, depressed humoral immune response	IRIS	-	-	-	-	-	-
1,4 Dichlorobenzene	-	-	-	-	-	-	2.29E-1	Medium	1	100	Increased liver Weight/nephropathy	IRIS
1,1 Dichloroethene	9E-3	Medium	1	1000	Hepatic lesions	IRIS	-	-	-	-	-	-
1,3 Dichloropropene	3E-4	Low	1	10,000	Increased organs weights	IRIS	2E-2	High	1	30	Hypertrophy of the nasal epithlium	IRIS
2,4 Dinitrophenol	2E-3	Low	-	1,000	Cataract formation	IRIS	-	-	-	-	-	-
2,4 Dinitrotoluene	2E-3	High	1	100	Neurotoxicity	IRIS	-	-	-	-	-	-
2,6 Dinitrotoluene	1E-3	-	1	3000	Mortality/neurotoxicity	HEAST	-	-	-	-	-	-
4-Chloroaniline	4E-3	Low	1	3000	Non-neopolastic lesions of the splenic capsule	IRIS	-	-	-	-	-	-
2-Nitroaniline	6E-5	-	-	-	-	IRIS	5.71E-5	-	-	-	Hematological effects	HEAST
3-Nitroaniline	3E-3	-	-	-	-	EPA Region III	-	-	-	-	-	-
4-Niroaniline	3E-3	-	-	-	-	EPA Region III	-	-	-	-	-	-
Aldrin	3E-5	Medium	1	1000	Liver toxicity	IRIS	-	-	-	-	-	-
Arsenic	3E-4	Medium	1	3	Hyperpigmentation, Keratosis	IRIS	-	-	-	-	-	-
Aroclor 1016	7E-5	-	1	100	Reduced birth weight, prenatally exposed neurobehavioral deficits	IRIS	-	-	-	-	-	-
Aroclor 1221	7E-5b	-	1	100	-	IRIS	-	-	-	-	-	-
Aroclor 1232	7E-5b	-	1	100	-	IRIS	-	-	-	-	-	-
Aroclor 1242	7E-5b	-	1	100	-	-	-	-	-	-	-	-
Aroclor 1254	2E-5	Medium	1	100	Ocular exudate, inflamed & prominent eyelid meibomian glands, distorted fingernails & toenail growth & decreased antibody response	IRIS	-	-	-	-	-	-
Aroclor 1260	7E-5b	-	1	100		IRIS	-	-	-	-	-	-

TABLE 3-24. ORAL/INHALATION CHRONIC NON-CARCINOGENIC TOXICITY VALUES FOR TIN CITY LRRS
(Page 2 of 2)

	Oral						Inhalation					
Chemical	RfD (mg/kg·day)	Confidence	MF	UF	Critical Effect	Source	RfC (mg/m^3)	Confidence	MF	UF	Critical Effect	Source
gamma-BHC (Lindane)	3E-4	Medium	1	1000	Liver and kidney toxicity	IRIS	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	2E-2	Medium	1	1000	Increased relative liver weight	IRIS	-	-	-	-	-	-
Bromodichloromethane	2E-2	Medium	1	1000	Renal cytomegaly	IRIS	-	-	-	-	-	-
Carbon disulfide	1E-1a	Medium	1	100	Fetal toxicity/malformations	IRIS	2.80E-03	Pending review	-	-	-	IRIS
Carbon tetrachloride	7E-4	Medium	1	1000	Liver lesions	IRIS	-	-	-	-	-	-
Chlordane, alpha	6E-5	Medium	1	1000	Liver hypertrophy	IRIS	-	-	-	-	-	-
Chloroform	1E-2	Medium	1	1000	Liver lesions	IRIS	-	-	-	-	-	-
Dibenzofuran	4E-3	-	-	-	-	EPA Region III	-	-	-	-	-	-
Dieldrin	5E-5	Medium	1	100	Liver lesions	IRIS	-	-	-	-	-	-
Heptachlor	5E-4	Low	1	300	Increased liver weight (males)	IRIS	-	-	-	-	-	-
Heptachlor Epoxide	1.3E-5	Low	1	1000	Increased liver to body weight ratio	IRIS	-	-	-	-	-	-
Hexachlorobenzene	8E-4	Medium	1	100	Liver effects	IRIS	-	-	-	-	-	-
Lead	N/A	N/A	-	-	Hematological changes, brain & kidney damage, CNS effects	IRIS	-	-	-	-	-	-
Pentachlorophenol	3E-2	High	1	100	Liver & kidney pathology	IRIS	-	-	-	-	-	-

a A Route to route extrapolation was performed.
b Based upon RfD for Aroclor 1016.
N/A = Not Applicable.
The following principle sources of toxicity values were used:

U.S. Environmental Protection Agency (EPA), 1994b, Integrated Risk Information System (IRIS), Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

U.S. Environmental Protection Agency (EPA), 1994a, Health Effects Assessment Summary Tables (HEAST), Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA) Region III, Risk Based Concentration Table, Fourth Quarter 1994c.

TABLE 3-25. ORAL/INHALATION CARCINOGENIC TOXICITY VALUES FOR TIN CITY LRRS

(Page 1 of 3)

	Slope Factor (mg/kg·day)$^{-1}$					
Chemical	Oral	Inhalation	Weight of Evidence	Oral	Inhalation	Source
1,1,2,2 Tetrachloroethane	2E-1	5.8E-5[b]	C	Hepatocellular carcinomas	-	IRIS
2,4,6 Trichlorophenol	1.1E-2	-	B2	Lymphoma, leukamia, hepatocellular carcinomas	-	IRIS
1,1,2 Trichloroethane	5.71E-2	1.6E-5[b]	C	Hepatocellular carcinomas	-	IRIS
1,4 Dichlorobenzene	2.4E-2	-	B2	Liver	-	HEAST
3,3' Dichlorobenzidine	4.5E-1	-	B2	Mammary gland, possible liver	-	IRIS
1,2 Dichloroethane	9.1E-2	2.6E-5[b]	B2	Lung papillomas, hemanigosarcomas	-	IRIS
1,1 Dichloroethene	6.0E-1	5.0E-05	C	Adrenal pheochromocytomas	Kidney adenocarcinoma	IRIS
2,4 Dinitrololuene/2,6 Dinitrololuene	6.8E-1[c]	-	B2	Liver, mammary gland	-	IRIS
Aldrin	1.71E+1	1.7E+1[b]	B2	Liver carcinomas	-	IRIS
Arsenic	1.75E+0	1.51E+1	A	Skin cancer	Lung	IRIS
Aroclor 1016	7.7E+0[c]	-	B2	Hepatocellular carcinomas	-	IRIS
Aroclor 1221	7.7E+0[c]	-	B2	Hepatocellular carcinomas	-	IRIS
Aroclor 1232	7.7E+0[c]	-	B2	Hepatocellular carcinomas	-	IRIS
Aroclor 1242	7.7E+0[c]	-	B2	Hepatocellular carcinomas	-	IRIS
Aroclor 1248	7.7E+0[c]	-	B2	Hepatocellular carcinomas	-	IRIS
Aroclor 1254	7.7E+0[c]	-	B2	Hepatocellular carcinomas	-	IRIS
Aroclor 1260	2.9E-2[a]	-	B2	Hepatocellular carcinomas	-	IRIS
Benzene	2.9E-2[a]	2.9E-2	A	Nonlymphocytic leukemia	Nonlymphocytic leukemia	IRIS
Benzo(a)anthracene	7.3E-1[d]	-	B2	Pulmonary adenoma & hepatoma	-	IRIS
Benzo(a)pyrene	7.3E+0	-	B2	Forestomach tumors, squamous cell papilomas & carcinomas	-	IRIS
Benzo(b)fluoranthene	7.3E-1[d]	-	B2	Epidermal carinomas & pleomorphic sarcomas	-	IRIS
Benzo(k)fluoranthene	7.3E-2[d]	-	B2	Lung papillomas and carcinomas	-	IRIS
BHC, alpha	6.3E+0	-	B2	Hepatocellular carcinomas	-	IRIS
BHC, beta	1.8E+0	-	C	Hepatocellular carcinomas	-	IRIS
Bis(2-Chloroethyl)ether	1.1E+0	-	B2	Hepatomas	-	IRIS
Bis(2-ethylhexyl)phthalate	1.4E-2	-	B2	Hepatocellular carcinomas/adenoma	-	IRIS

TABLE 3-25. ORAL/INHALATION CARCINOGENIC TOXICITY VALUES FOR TIN CITY LRRS

	Slope Factor (mg/kg·day)$^{-1}$					
Chemical	Oral	Inhalation	Weight of Evidence	Oral	Inhalation	Source
Bromodichloromethane	6.2E-2	-	B2	Kidney	-	IRIS
Carbon tetrachloride	1.3E-1	5.3E-2[b]	B2	Hepatocellular carcinomas, hematomas	-	IRIS
Chlordane, alpha	1.3E+0	1.29E+0[b]	B2	Hepatocellular carcinomas	-	IRIS
Chlorodane, gamma	1.3E+0	1.29E+0[b]	B2	Hepatocellular carcinomas	-	IRIS
Chloroform	6.1E-3	8.1E-2[b]	B2	Kidney epithelial tumors, hepatic carcinomas	-	IRIS
Chrysene	7.3E-3[d]	-	B2	Carcinomas, malignant lymphomas	-	IRIS
Dibenzo(a,h)anthracene	7.3E+0[d]	-	B2	Pulmonary carcinomas	-	IRIS
Dieldrin	1.6E+1	1.6E+1[b]	B2	Liver carcinomas	-	IRIS
Heptachlor	4.5E+0	1.3E-3[b]	B2	Hepatocellular carcinomas	-	IRIS
Heptachlor epoxide	9.1E+0	9.1E+0	B2	Hepatocellular carcinomas	-	IRIS
Hexachlorobenzene	1.6E+0	-	B2	liver, thryoid, kidney	-	IRIS
Hexachlorobutadiene	7.8E-2	-	C	Renal tubular adenomas	-	IRIS
Indeno(1,2,3-cd)pyrene	7.3E-1[d]	-	B2	Lung(epidermoid carcinomas)	-	IRIS
Lead	N/A	N/A	B2	Renal	-	IRIS
N-Nitrosodi-n-propylamine	7.0E+0	-	-	Hepatocellular carcinomas	-	IRIS
N-Nitrosodiphenylamine	4.9E-3	-	C	Bladder	-	IRIS
Pentachlorophenol	1.2E-1	-	B2	Hepatocellular adenomas & carcinomas	-	IRIS
Toxaphene	1.1E+0	1.1E+0[h]	B2	Hepatocellular carcinomas, neoplastic nodules (adenomas)	-	IRIS
Vinyl Chloride	1.9E+0	3.0E-1	A	Lung and liver	Liver	HEAST

TABLE 3-25. ORAL/INHALATION CARCINOGENIC TOXICITY VALUES FOR TIN CITY LRRS

[a]Based on route to route extrapolation from inhalation.

[b]Based on route to route extrapolation from oral ingestion.

[c]Based upon SF for PCB's.

[d]SF derived from Benzo(a)pyrene using a relative potency of:

Benzo(a)anthracene	=0.1
Benzo(b)fluoranthene	=0.1
Benzo(k)fluoranthene	=0.01
Dibenzo(a,h)anthracene	=1.0
Chrysene	=0.001
Indeno(1,2,3-cd)pyrene	=0.1

[e]Carcinogenic effects only noted for the mixture of 2,4 Dinitrotoluene and 2,6 Dinitrotoluene.

The following principle sources of toxicity values were used:

U.S. Environmental Protection Agency (EPA), 1994b. Integrated Risk Information System (IRIS), Office of Health and Evironmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

U.S. Environmental Protection Agency 1994a, Health Effects Assessment Summary Tables (HEAST), Office of Solid Waste and Emergency Response, Washington, D.C.

Weight of Evidence:
A - Human Carcinogen
B1 - Probable human carcinogen, Limited human evidence
B2 - Probable human carcinogen, Sufficient evidence in animals, no human evidence
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of non-carcinogenicity in humans

TABLE 3-26. ORAL ABSORPTION EFFICIENCY FACTORS FOR TIN CITY LRRS		
CHEMICAL	ORAL ABSORPTION EFFICIENCIES	REFERENCE
Aldrin	0.5	ATSDR 1993a
Aroclor 1016	0.90	Adopted from Aroclor 1260
Aroclor 1221	0.90	Adopted from Aroclor 1260
Aroclor 1232	0.90	Adopted from Aroclor 1260
Aroclor 1242	0.90	Adopted from Aroclor 1260
Aroclor 1248	0.90	Adopted from Aroclor 1260
Aroclor 1254	0.90	Adopted from Aroclor 1260
Aroclor 1260	0.90	ATSDR 1993d
Benzo(a)pyrene	0.8	ATSDR 1993e
Benzo(a)anthracene	0.85	ATSDR 1993e
Benzo(b)fluoranthene	0.85	ATSDR 1993e
BHC, alpha	0.97	ATSDR 1989c
BHC, beta	0.91	ATSDR 1989c
BHC, gamma (Lindane)	0.99	ATSDR 1989c
bis(2-ethylhexyl)phthalate	0.55	ATSDR 1991b
Chlordane	0.80	ATSDR 1989d
Chrysene	0.87	ATSDR 1993e
Dichlorobenzidine, 3,3'-	0.90	ATSDR 1989e
Dichloroethane, 1,2-	1.0	ATSDR 1989e
Dichloroethene, 1,1-	1.0	ATSDR 1989e
Dieldrin	0.50	ATSDR 1993a
Dinitrotoluene, 2,4-	0.90	ATSDR 1988
Dinitrotoluene, 2,6-	0.90	ATSDR 1988
Heptachlor eopoxide	0.66	ATSDR 1991c
N-nitrosodi-n-propylamine	0.78	ATSDR 1989e
N-nitrosodiphenylamine	0.98	ATSDR 1989e
Trichloroethane, 1,1,2-	1.0	ATSDR 1989e
Vinyl chloride	0.03	ATSDR 1992

Table 3-27. Carcinogenic and Non-carcinogenic Risks for Detected COPCs at the Beach Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Lead	Dermal Contact with Soil	5.1	mg/kg				
Arsenic	Dermal Contact with Surface Water	1.4	ug/L				
Chromium	Dermal Contact with Surface Water	6	ug/L				
Lead	Dermal Contact with Surface Water	468	ug/L				
Arsenic	Dermal Contact with Sediment	7.5	mg/kg				
Chromium	Dermal Contact with Sediment	27.4	mg/kg				
Lead	Dermal Contact with Sediment	118	mg/kg				
Arsenic	Ingestion of Sediment	7.5	mg/kg	7.93E-9	5.87E-5	2.47E-8	5.48E-4
Chromium	Ingestion of Sediment	27.4	mg/kg		6.43E-8		6.01E-7
Lead	Ingestion of Sediment	118	mg/kg				
Lead	Ingestion of Soil	5.1	mg/kg				

Table 3-28. Carcinogenic and Non-carcinogenic Risks for Detected COPCs at the Lower Camp, Tramway and Top Camp Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Lead	Dermal Contact with Soil	357	mg/kg				
Aroclor 1242	Dermal Contact with Soil	3.2	mg/kg	1.00E-5	7.23E-2	6.17E-6	1.34E-1
Aroclor 1254	Dermal Contact with Soil	1.3	mg/kg	4.07E-6	1.03E-1	2.51E-6	1.90E-1
Aroclor 1260	Dermal Contact with Soil	0.79	mg/kg	2.47E-6	1.78E-2	1.52E-6	3.30E-2
Lead	Ingestion of Soil	357	mg/kg				
Aroclor 1242	Ingestion of Soil	3.2	mg/kg	1.49E-8	1.07E-4	4.63E-8	1.00E-3
Aroclor 1254	Ingestion of Soil	1.3	mg/kg	6.04E-9	1.53E-4	1.88E-8	1.42E-3
Aroclor 1260	Ingestion of Soil	0.79	mg/kg	3.67E-9	2.65E-5	1.14E-8	2.47E-4

Table 3-29. Carcinogenic and Non-carcinogenic Risks for Detected COPCs at the DP 011b Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
1,3,5-Trimethylbenzene	Dermal Contact with Soil	0.038	mg/kg				
1,3,5-Trimethylbenzene	Ingestion of Soil	0.038	mg/kg				

Table 3-30. Carcinogenic and Non-carcinogenic Risks for Detected COPCs in Background Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Arsenic	Dermal Contact with Soil	0.72	mg/kg				
Chromium	Dermal Contact with Soil	1.3	mg/kg				
Lead	Dermal Contact with Soil	4.7	mg/kg				
Aroclor 1254	Dermal Contact with Soil	0.31	mg/kg	9.71E-7	2.45E-2	5.98E-7	4.53E-2
Arsenic	Dermal Contact with Surface Water	7.4	ug/L				
Chromium	Dermal Contact with Surface Water	25.8	ug/L				
Lead	Dermal Contact with Surface Water	9.4	ug/L				
Arsenic	Inhalation of Dust	1.9274E-08	mg/m3	3.51E-9		3.28E-9	
Arsenic	Ingestion of Soil	0.72	mg/kg	7.61E-10	5.64E-6	2.37E-9	5.26E-5
Chromium	Ingestion of Soil	1.3	mg/kg		3.05E-9		2.85E-8
Lead	Ingestion of Soil	4.7	mg/kg				
Aroclor 1254	Ingestion of Soil	0.31	mg/kg	1.44E-9	1.46E-14	4.48E-9	3.40E-4

Table 3-31. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Beach Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
2,4-Dinitrotoluene	Dermal Contact with Soil	0.185	mg/kg	3.41E-8	9.75E-5	2.10E-8	1.80E-4
2,6-Dinitrotoluene	Dermal Contact with Soil	0.185	mg/kg	3.41E-8	1.95E-4	2.10E-8	3.60E-4
3,3'-Dichlorobenzidine	Dermal Contact with Soil	0.365	mg/kg	4.45E-8		2.74E-8	
Benzo(a)anthracene	Dermal Contact with Soil	0.185	mg/kg	5.81E-8		3.58E-8	
Benzo(a)pyrene	Dermal Contact with Soil	0.185	mg/kg	6.18E-7		3.81E-7	
Benzo(b)fluoranthene	Dermal Contact with Soil	0.185	mg/kg	5.81E-8		3.58E-8	
Benzo(k)fluoranthene	Dermal Contact with Soil	0.185	mg/kg				
Chrysene	Dermal Contact with Soil	0.185	mg/kg	5.68E-10		3.50E-10	
Dibenzo(a,h)anthracene	Dermal Contact with Soil	0.185	mg/kg				
Hexachlorobenzene	Dermal Contact with Soil	0.185	mg/kg				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Soil	0.185	mg/kg				
N-Nitrosodi-n-propylamine	Dermal Contact with Soil	0.185	mg/kg	4.05E-7		2.50E-7	
Pentachlorophenol	Dermal Contact with Soil	0.9	mg/kg				
bis(2-Chloroethyl)ether	Dermal Contact with Soil	0.185	mg/kg				
Aldrin	Dermal Contact with Sediment	0.006	mg/kg	7.47E-8	5.69E-4	4.60E-8	1.05E-3
Aroclor 1016	Dermal Contact with Sediment	0.12	mg/kg	3.76E-7	2.71E-3	2.31E-7	5.01E-3
Aroclor 1221	Dermal Contact with Sediment	0.245	mg/kg	7.67E-7	5.53E-3	4.73E-7	1.02E-2
Aroclor 1232	Dermal Contact with Sediment	0.12	mg/kg	3.76E-7	2.71E-3	2.31E-7	5.01E-3
Aroclor 1242	Dermal Contact with Sediment	0.12	mg/kg	3.76E-7	2.71E-3	2.31E-7	5.01E-3
Aroclor 1248	Dermal Contact with Sediment	0.12	mg/kg	3.76E-7	2.71E-3	2.31E-7	5.01E-3
Aroclor 1254	Dermal Contact with Sediment	0.12	mg/kg	3.76E-7	9.49E-3	2.31E-7	1.75E-2
Aroclor 1260	Dermal Contact with Sediment	0.12	mg/kg	3.76E-7	2.71E-3	2.31E-7	5.01E-3
Dieldrin	Dermal Contact with Sediment	0.012	mg/kg	1.41E-7	6.83E-4	8.66E-8	1.26E-3
Heptachlor	Dermal Contact with Sediment	0.006	mg/kg				
Heptachlor Epoxide	Dermal Contact with Sediment	0.006	mg/kg	3.03E-8	9.95E-4	1.87E-8	1.84E-3
Toxaphene	Dermal Contact with Sediment	0.6	mg/kg				
alpha-BHC	Dermal Contact with Sediment	0.006	mg/kg	1.43E-8		8.79E-9	
alpha-Chlordane	Dermal Contact with Sediment	0.006	mg/kg	3.57E-9	1.78E-4	2.20E-9	3.29E-4
gamma-Chlordane	Dermal Contact with Sediment	0.006	mg/kg	3.57E-9	1.78E-4	2.20E-9	3.29E-4
2,4-Dinitrotoluene	Dermal Contact with Sediment	0.245	mg/kg	4.52E-8	1.29E-4	2.78E-8	2.39E-4
2,6-Dinitrotoluene	Dermal Contact with Sediment	0.245	mg/kg	4.52E-8	2.58E-4	2.78E-8	4.77E-4
2-Nitroaniline	Dermal Contact with Sediment	1.2	mg/kg				

Table 3-31. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Beach Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
3,3'-Dichlorobenzidine	Dermal Contact with Sediment	0.485	mg/kg	5.92E-8		3.64E-8	
Benzo(a)anthracene	Dermal Contact with Sediment	0.245	mg/kg	7.70E-8		4.74E-8	
Benzo(a)pyrene	Dermal Contact with Sediment	0.245	mg/kg	8.18E-7		5.04E-7	
Benzo(b)fluoranthene	Dermal Contact with Sediment	0.245	mg/kg	7.70E-8		4.74E-8	
Benzo(k)fluoranthene	Dermal Contact with Sediment	0.245	mg/kg				
Chrysene	Dermal Contact with Sediment	0.245	mg/kg	7.52E-10		4.63E-10	
Dibenzo(a,h)anthracene	Dermal Contact with Sediment	0.245	mg/kg				
Hexachlorobenzene	Dermal Contact with Sediment	0.245	mg/kg				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Sediment	0.245	mg/kg				
N-Nitrosodi-n-propylamine	Dermal Contact with Sediment	0.245	mg/kg	5.36E-7		3.30E-7	
Pentachlorophenol	Dermal Contact with Sediment	1.2	mg/kg				
bis(2-Chloroethyl)ether	Dermal Contact with Sediment	0.245	mg/kg				
Aldrin	Dermal Contact with Surface Water	0.0125	ug/L	1.66E-9	1.26E-5	1.02E-9	2.34E-5
Aroclor 1016	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1221	Dermal Contact with Surface Water	0.5	ug/L				
Aroclor 1232	Dermal Contact with Surface Water	0.5	ug/L				
Aroclor 1242	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1248	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1254	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1260	Dermal Contact with Surface Water	0.25	ug/L				
Dieldrin	Dermal Contact with Surface Water	0.025	ug/L	3.12E-8	1.52E-4	1.92E-8	2.81E-4
Heptachlor	Dermal Contact with Surface Water	0.0125	ug/L				
Heptachlor Epoxide	Dermal Contact with Surface Water	0.0125	ug/L				
Toxaphene	Dermal Contact with Surface Water	1.25	ug/L				
alpha-BHC	Dermal Contact with Surface Water	0.025	ug/L				
alpha-Chlordane	Dermal Contact with Surface Water	0.25	ug/L	5.15E-8	2.57E-3	3.17E-8	4.75E-3
gamma-Chlordane	Dermal Contact with Surface Water	0.25	ug/L	5.15E-8	2.57E-3	3.17E-8	4.75E-3
1,2,4-Trichlorobenzene	Dermal Contact with Surface Water	5	ug/L				
1,4-Dichlorobenzene	Dermal Contact with Surface Water	5	ug/L				
2,2'-Oxybis(1-chloropropane)	Dermal Contact with Surface Water	5	ug/L				
2,4,6-Trichlorophenol	Dermal Contact with Surface Water	5	ug/L				
2,4-Dinitrophenol	Dermal Contact with Surface Water	25	ug/L				

Table 3-31. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Beach Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
2,4-Dinitrotoluene	Dermal Contact with Surface Water	5	ug/L	3.50E-8	1.00E-4	2.16E-8	1.85E-4
2,6-Dinitrotoluene	Dermal Contact with Surface Water	5	ug/L	2.30E-8	1.32E-4	1.42E-8	2.44E-4
2-Nitroaniline	Dermal Contact with Surface Water	25	ug/L				
3,3'-Dichlorobenzidine	Dermal Contact with Surface Water	10	ug/L	2.07E-7		1.28E-7	
3-Nitroaniline	Dermal Contact with Surface Water	25	ug/L				
4-Chloroaniline	Dermal Contact with Surface Water	10	ug/L				
4-Nitroaniline	Dermal Contact with Surface Water	25	ug/L				
Benzo(a)anthracene	Dermal Contact with Surface Water	5	ug/L	8.49E-6		5.23E-6	
Benzo(a)pyrene	Dermal Contact with Surface Water	5	ug/L	1.34E-4		8.23E-5	
Benzo(b)fluoranthene	Dermal Contact with Surface Water	5	ug/L	1.26E-5		7.74E-6	
Benzo(k)fluoranthene	Dermal Contact with Surface Water	5	ug/L				
Chrysene	Dermal Contact with Surface Water	5	ug/L	8.29E-8		5.11E-8	
Dibenzo(a,h)anthracene	Dermal Contact with Surface Water	5	ug/L				
Dibenzofuran	Dermal Contact with Surface Water	5	ug/L				
Hexachlorobenzene	Dermal Contact with Surface Water	5	ug/L				
Hexachlorobutadiene	Dermal Contact with Surface Water	5	ug/L				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Surface Water	5	ug/L				
N-Nitrosodi-n-propylamine	Dermal Contact with Surface Water	5	ug/L				
Pentachlorophenol	Dermal Contact with Surface Water	25	ug/L				
bis(2-Chloroethyl)ether	Dermal Contact with Surface Water	5	ug/L				
bis(2-Ethylhexyl)Phthalate	Dermal Contact with Surface Water	5	ug/L				
1,1,2,2-Tetrachloroethane	Dermal Contact with Surface Water	0.5	ug/L				
1,1,2-Trichloroethane	Dermal Contact with Surface Water	0.5	ug/L	5.84E-10	9.96E-6	3.60E-10	1.84E-5
1,1-Dichloroethene	Dermal Contact with Surface Water	0.5	ug/L				
1,2-Dichloroethane	Dermal Contact with Surface Water	0.5	ug/L	5.88E-10		3.62E-10	
Benzene	Dermal Contact with Surface Water	0.5	ug/L				
Bromodichloromethane	Dermal Contact with Surface Water	0.5	ug/L				
Carbon tetrachloride	Dermal Contact with Surface Water	0.5	ug/L				
Chloroform	Dermal Contact with Surface Water	0.5	ug/L				
Vinyl chloride	Dermal Contact with Surface Water	0.5	ug/L	5.64E-7		3.47E-7	
cis-1,3-Dichloropropene	Dermal Contact with Surface Water	0.5	ug/L				
trans-1,3-Dichloropropene	Dermal Contact with Surface Water	0.5	ug/L				

Table 3-31. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Beach Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
2,4-Dinitrotoluene	Ingestion of Soil	0.185	mg/kg	7.60E-11	2.17E-7	2.36E-10	2.03E-6
2,6-Dinitrotoluene	Ingestion of Soil	0.185	mg/kg	7.60E-11	4.34E-7	2.36E-10	4.05E-6
3,3'-Dichlorobenzidine	Ingestion of Soil	0.365	mg/kg	9.92E-11		3.09E-10	
Benzo(a)anthracene	Ingestion of Soil	0.185	mg/kg	8.16E-11		2.54E-10	
Benzo(a)pyrene	Ingestion of Soil	0.185	mg/kg	8.16E-10		2.54E-9	
Benzo(b)fluoranthene	Ingestion of Soil	0.185	mg/kg	8.16E-11		2.54E-10	
Benzo(k)fluoranthene	Ingestion of Soil	0.185	mg/kg	8.16E-12		2.54E-11	
Chrysene	Ingestion of Soil	0.185	mg/kg	8.16E-13		2.54E-12	
Dibenzo(a,h)anthracene	Ingestion of Soil	0.185	mg/kg	8.16E-10		2.54E-9	
Hexachlorobenzene	Ingestion of Soil	0.185	mg/kg	1.79E-10	5.43E-7	5.56E-10	5.07E-6
Indeno(1,2,3-c,d)pyrene	Ingestion of Soil	0.185	mg/kg	8.16E-11		2.54E-10	
N-Nitrosodi-n-propylamine	Ingestion of Soil	0.185	mg/kg	7.82E-10		2.43E-9	
Pentachlorophenol	Ingestion of Soil	0.9	mg/kg	6.52E-11	7.05E-8	2.03E-10	6.58E-7
bis(2-Chloroethyl)ether	Ingestion of Soil	0.185	mg/kg	1.23E-10		3.82E-10	
Aldrin	Ingestion of Sediment	0.006	mg/kg	6.16E-11	4.70E-7	1.92E-10	4.38E-6
Aroclor 1016	Ingestion of Sediment	0.12	mg/kg	5.58E-10	4.03E-6	1.74E-9	3.76E-5
Aroclor 1221	Ingestion of Sediment	0.245	mg/kg	1.14E-9	8.22E-6	3.54E-9	7.67E-5
Aroclor 1232	Ingestion of Sediment	0.12	mg/kg	5.58E-10	4.03E-6	1.74E-9	3.76E-5
Aroclor 1242	Ingestion of Sediment	0.12	mg/kg	5.58E-10	4.03E-6	1.74E-9	3.76E-5
Aroclor 1248	Ingestion of Sediment	0.12	mg/kg	5.58E-10	4.03E-6	1.74E-9	3.76E-5
Aroclor 1254	Ingestion of Sediment	0.12	mg/kg	5.58E-10	1.41E-5	1.74E-9	1.32E-4
Aroclor 1260	Ingestion of Sediment	0.12	mg/kg	5.58E-10	4.03E-6	1.74E-9	3.76E-5
Dieldrin	Ingestion of Sediment	0.012	mg/kg	1.16E-10	5.64E-7	3.61E-10	5.26E-6
Heptachlor	Ingestion of Sediment	0.006	mg/kg	1.63E-11	2.82E-8	5.07E-11	2.63E-7
Heptachlor Epoxide	Ingestion of Sediment	0.006	mg/kg	3.30E-11	1.08E-6	1.03E-10	1.01E-5
Toxaphene	Ingestion of Sediment	0.6	mg/kg	3.99E-10		1.24E-9	
alpha-BHC	Ingestion of Sediment	0.006	mg/kg	2.28E-11		7.10E-11	
alpha-Chlordane	Ingestion of Sediment	0.006	mg/kg	4.71E-12	2.35E-7	1.47E-11	2.19E-6
gamma-Chlordane	Ingestion of Sediment	0.006	mg/kg	4.71E-12	2.35E-7	1.47E-11	2.19E-6

Table 3-31. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Beach Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
2,4-Dinitrotoluene	Ingestion of Sediment	0.245	mg/kg	1.01E-10	2.88E-7	3.13E-10	2.68E-6
2,6-Dinitrotoluene	Ingestion of Sediment	0.245	mg/kg	1.01E-10	5.75E-7	3.13E-10	5.37E-6
2-Nitroaniline	Ingestion of Sediment	1.2	mg/kg		4.70E-5		4.38E-4
3,3'-Dichlorobenzidine	Ingestion of Sediment	0.485	mg/kg	1.32E-10		4.10E-10	
Benzo(a)anthracene	Ingestion of Sediment	0.245	mg/kg	1.08E-10		3.36E-10	
Benzo(a)pyrene	Ingestion of Sediment	0.245	mg/kg	1.08E-9		3.36E-9	
Benzo(b)fluoranthene	Ingestion of Sediment	0.245	mg/kg	1.08E-10		3.36E-10	
Benzo(k)fluoranthene	Ingestion of Sediment	0.245	mg/kg	1.08E-11		3.36E-11	
Chrysene	Ingestion of Sediment	0.245	mg/kg	1.08E-12		3.36E-12	
Dibenzo(a,h)anthracene	Ingestion of Sediment	0.245	mg/kg	1.08E-9		3.36E-9	
Hexachlorobenzene	Ingestion of Sediment	0.245	mg/kg	2.37E-10	7.19E-7	7.36E-10	6.71E-6
Indeno(1,2,3-c,d)pyrene	Ingestion of Sediment	0.245	mg/kg	1.08E-10		3.36E-10	
N-Nitrosodi-n-propylamine	Ingestion of Sediment	0.245	mg/kg	1.04E-9		3.22E-9	
Pentachlorophenol	Ingestion of Sediment	1.2	mg/kg	8.70E-11	9.39E-8	2.71E-10	8.77E-7
bis(2-Chloroethyl)ether	Ingestion of Sediment	0.245	mg/kg	1.48E-10		4.60E-10	

Table 3-32. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Lower Camp, Tramway and Top Camp Areas Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Arsenic	Dermal Contact with Soil	0.05	mg/kg				
Aldrin	Dermal Contact with Soil	0.018	mg/kg	2.24E-7	1.71E-3	1.38E-7	3.16E-3
Aroclor 1016	Dermal Contact with Soil	0.35	mg/kg	1.10E-6	7.91E-3	6.75E-7	1.46E-2
Aroclor 1221	Dermal Contact with Soil	0.7	mg/kg	2.19E-6	1.58E-2	1.35E-6	2.92E-2
Aroclor 1232	Dermal Contact with Soil	0.35	mg/kg	1.10E-6	7.91E-3	6.75E-7	1.46E-2
Aroclor 1248	Dermal Contact with Soil	0.35	mg/kg	1.10E-6	7.91E-3	6.75E-7	1.46E-2
Toxaphene	Dermal Contact with Soil	1.8	mg/kg				
2,4-Dinitrotoluene	Dermal Contact with Soil	0.175	mg/kg	3.23E-8	9.22E-5	1.99E-8	1.70E-4
2,6-Dinitrotoluene	Dermal Contact with Soil	0.175	mg/kg	3.23E-8	1.84E-4	1.99E-8	3.41E-4
3,3'-Dichlorobenzidine	Dermal Contact with Soil	0.345	mg/kg	4.21E-8		2.59E-8	
Benzo(a)anthracene	Dermal Contact with Soil	0.175	mg/kg	5.50E-8		3.39E-8	
Benzo(a)pyrene	Dermal Contact with Soil	0.175	mg/kg	5.84E-7		3.60E-7	
Benzo(b)fluoranthene	Dermal Contact with Soil	0.175	mg/kg	5.50E-8		3.39E-8	
Benzo(k)fluoranthene	Dermal Contact with Soil	0.175	mg/kg				
Chrysene	Dermal Contact with Soil	0.175	mg/kg	5.37E-10		3.31E-10	
Dibenzo(a,h)anthracene	Dermal Contact with Soil	0.175	mg/kg				
Hexachlorobenzene	Dermal Contact with Soil	0.175	mg/kg				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Soil	0.175	mg/kg				
N-Nitrosodi-n-propylamine	Dermal Contact with Soil	0.175	mg/kg	3.83E-7		2.36E-7	
Pentachlorophenol	Dermal Contact with Soil	0.85	mg/kg				
bis(2-Chloroethyl)ether	Dermal Contact with Soil	0.175	mg/kg				
Arsenic	Ingestion of Soil	0.05	mg/kg	5.28E-11	3.91E-7	1.64E-10	3.65E-6
Aldrin	Ingestion of Soil	0.018	mg/kg	1.85E-10	1.41E-6	5.75E-10	1.32E-5
Aroclor 1016	Ingestion of Soil	0.35	mg/kg	1.63E-9	1.17E-5	5.06E-9	1.10E-4
Aroclor 1221	Ingestion of Soil	0.7	mg/kg	3.25E-9	2.35E-5	1.01E-8	2.19E-4
Aroclor 1232	Ingestion of Soil	0.35	mg/kg	1.63E-9	1.17E-5	5.06E-9	1.10E-4
Aroclor 1248	Ingestion of Soil	0.35	mg/kg	1.63E-9	1.17E-5	5.06E-9	1.10E-4
Toxaphene	Ingestion of Soil	1.8	mg/kg	1.20E-9		3.72E-9	
2,4-Dinitrotoluene	Ingestion of Soil	0.175	mg/kg	7.19E-11	2.05E-7	2.24E-10	1.92E-6
2,6-Dinitrotoluene	Ingestion of Soil	0.175	mg/kg	7.19E-11	4.11E-7	2.24E-10	3.84E-6
3,3'-Dichlorobenzidine	Ingestion of Soil	0.345	mg/kg	9.37E-11		2.92E-10	

Table 3-32. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Lower Camp, Tramway and Top Camp Areas Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Benzo(a)anthracene	Ingestion of Soil	0.175	mg/kg	7.71E-11		2.40E-10	
Benzo(a)pyrene	Ingestion of Soil	0.175	mg/kg	7.71E-10		2.40E-9	
Benzo(b)fluoranthene	Ingestion of Soil	0.175	mg/kg	7.71E-11		2.40E-10	
Benzo(k)fluoranthene	Ingestion of Soil	0.175	mg/kg	7.71E-12		2.40E-11	
Chrysene	Ingestion of Soil	0.175	mg/kg	7.71E-13		2.40E-12	
Dibenzo(a,h)anthracene	Ingestion of Soil	0.175	mg/kg	7.71E-10		2.40E-9	
Hexachlorobenzene	Ingestion of Soil	0.175	mg/kg	1.69E-10	5.14E-7	5.26E-10	4.79E-6
Indeno(1,2,3-c,d)pyrene	Ingestion of Soil	0.175	mg/kg	7.71E-11		2.40E-10	
N-Nitrosodi-n-propylamine	Ingestion of Soil	0.175	mg/kg	7.40E-10		2.30E-9	
Pentachlorophenol	Ingestion of Soil	0.85	mg/kg	6.16E-11	6.65E-8	1.92E-10	6.21E-7
bis(2-Chloroethyl)ether	Ingestion of Soil	0.175	mg/kg	1.06E-10		3.29E-10	

Table 3-33. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Airstrip Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
2,4-Dinitrotoluene	Dermal Contact with Soil	0.185	mg/kg	3.41E-8	9.75E-5	2.10E-8	1.80E-4
2,6-Dinitrotoluene	Dermal Contact with Soil	0.185	mg/kg	3.41E-8	1.95E-4	2.10E-8	3.60E-4
3,3'-Dichlorobenzidine	Dermal Contact with Soil	0.37	mg/kg	4.51E-8		2.78E-8	
Benzo(a)anthracene	Dermal Contact with Soil	0.185	mg/kg	5.81E-8		3.58E-8	
Benzo(a)pyrene	Dermal Contact with Soil	0.185	mg/kg	6.18E-7		3.81E-7	
Benzo(b)fluoranthene	Dermal Contact with Soil	0.185	mg/kg	5.81E-8		3.58E-8	
Benzo(k)fluoranthene	Dermal Contact with Soil	0.185	mg/kg				
Chrysene	Dermal Contact with Soil	0.185	mg/kg	5.68E-10		3.50E-10	
Dibenzo(a,h)anthracene	Dermal Contact with Soil	0.185	mg/kg				
Hexachlorobenzene	Dermal Contact with Soil	0.185	mg/kg				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Soil	0.185	mg/kg				
N-Nitrosodi-n-propylamine	Dermal Contact with Soil	0.185	mg/kg	4.05E-7		2.50E-7	
Pentachlorophenol	Dermal Contact with Soil	0.9	mg/kg				
bis(2-Chloroethyl)ether	Dermal Contact with Soil	0.185	mg/kg				
Aldrin	Dermal Contact with Sediment	0.001	mg/kg	1.24E-8	9.49E-5	7.66E-9	1.75E-4
Aroclor 1016	Dermal Contact with Sediment	0.0215	mg/kg	6.73E-8	4.86E-4	4.15E-8	8.98E-4
Aroclor 1221	Dermal Contact with Sediment	0.0435	mg/kg	1.36E-7	9.83E-4	8.39E-8	1.82E-3
Aroclor 1232	Dermal Contact with Sediment	0.0215	mg/kg	6.73E-8	4.86E-4	4.15E-8	8.98E-4
Aroclor 1242	Dermal Contact with Sediment	0.0215	mg/kg	6.73E-8	4.86E-4	4.15E-8	8.98E-4
Aroclor 1248	Dermal Contact with Sediment	0.0215	mg/kg	6.73E-8	4.86E-4	4.15E-8	8.98E-4
Aroclor 1254	Dermal Contact with Sediment	0.0215	mg/kg	6.73E-8	1.70E-3	4.15E-8	3.14E-3
Aroclor 1260	Dermal Contact with Sediment	0.0215	mg/kg	6.73E-8	4.86E-4	4.15E-8	8.98E-4
Dieldrin	Dermal Contact with Sediment	0.002	mg/kg	2.34E-8	1.14E-4	1.44E-8	2.10E-4
Heptachlor	Dermal Contact with Sediment	0.001	mg/kg				
Heptachlor Epoxide	Dermal Contact with Sediment	0.001	mg/kg	5.05E-9	1.66E-4	3.11E-9	3.07E-4
Toxaphene	Dermal Contact with Sediment	0.11	mg/kg				
alpha-BHC	Dermal Contact with Sediment	0.001	mg/kg	2.38E-9		1.46E-9	
alpha-Chlordane	Dermal Contact with Sediment	0.001	mg/kg	5.95E-10	2.96E-5	3.66E-10	5.48E-5
gamma-Chlordane	Dermal Contact with Sediment	0.001	mg/kg	5.95E-10	2.96E-5	3.66E-10	5.48E-5
2,4-Dinitrotoluene	Dermal Contact with Sediment	0.215	mg/kg	3.96E-8	1.13E-4	2.44E-8	2.09E-4
2,6-Dinitrotoluene	Dermal Contact with Sediment	0.215	mg/kg	3.96E-8	2.27E-4	2.44E-8	4.19E-4
2-Nitroaniline	Dermal Contact with Sediment	1.05	mg/kg				

Table 3-33. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Airstrip Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
3,3'-Dichlorobenzidine	Dermal Contact with Sediment	0.43	mg/kg	5.25E-8		3.23E-8	
Benzo(a)anthracene	Dermal Contact with Sediment	0.215	mg/kg	6.76E-8		4.16E-8	
Benzo(a)pyrene	Dermal Contact with Sediment	0.215	mg/kg	7.18E-7		4.42E-7	
Benzo(b)fluoranthene	Dermal Contact with Sediment	0.215	mg/kg	6.76E-8		4.16E-8	
Benzo(k)fluoranthene	Dermal Contact with Sediment	0.215	mg/kg				
Chrysene	Dermal Contact with Sediment	0.215	mg/kg	6.60E-10		4.07E-10	
Dibenzo(a,h)anthracene	Dermal Contact with Sediment	0.215	mg/kg				
Hexachlorobenzene	Dermal Contact with Sediment	0.215	mg/kg				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Sediment	0.215	mg/kg				
N-Nitrosodi-n-propylamine	Dermal Contact with Sediment	0.215	mg/kg	4.71E-7		2.90E-7	
Pentachlorophenol	Dermal Contact with Sediment	1.05	mg/kg				
bis(2-Chloroethyl)ether	Dermal Contact with Sediment	0.215	mg/kg				
Aldrin	Dermal Contact with Surface Water	0.125	ug/L	1.66E-8	1.26E-4	1.02E-8	2.34E-4
Aroclor 1016	Dermal Contact with Surface Water	2.5	ug/L				
Aroclor 1221	Dermal Contact with Surface Water	5	ug/L				
Aroclor 1232	Dermal Contact with Surface Water	2.5	ug/L				
Aroclor 1242	Dermal Contact with Surface Water	2.5	ug/L				
Aroclor 1248	Dermal Contact with Surface Water	2.5	ug/L				
Aroclor 1254	Dermal Contact with Surface Water	2.5	ug/L				
Aroclor 1260	Dermal Contact with Surface Water	2.5	ug/L				
Dieldrin	Dermal Contact with Surface Water	0.25	ug/L	3.12E-7	1.52E-3	1.92E-7	2.81E-3
Heptachlor	Dermal Contact with Surface Water	0.125	ug/L				
Heptachlor Epoxide	Dermal Contact with Surface Water	0.125	ug/L				
Toxaphene	Dermal Contact with Surface Water	12.5	ug/L				
alpha-BHC	Dermal Contact with Surface Water	0.125	ug/L				
alpha-Chlordane	Dermal Contact with Surface Water	2.5	ug/L	5.15E-7	2.57E-2	3.17E-7	4.75E-2
gamma-Chlordane	Dermal Contact with Surface Water	2.5	ug/L	5.15E-7	2.57E-2	3.17E-7	4.75E-2
1,2,4-Trichlorobenzene	Dermal Contact with Surface Water	5	ug/L				
1,4-Dichlorobenzene	Dermal Contact with Surface Water	5	ug/L				
2,2'-Oxybis(1-chloropropane)	Dermal Contact with Surface Water	5	ug/L				
2,4,6-Trichlorophenol	Dermal Contact with Surface Water	5	ug/L				
2,4-Dinitrophenol	Dermal Contact with Surface Water	25	ug/L				

Table 3-33. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Airstrip Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
2,4-Dinitrotoluene	Dermal Contact with Surface Water	5	ug/L	3.50E-8	1.00E-4	2.16E-8	1.85E-4
2,6-Dinitrotoluene	Dermal Contact with Surface Water	5	ug/L	2.30E-8	1.32E-4	1.42E-8	2.44E-4
2-Nitroaniline	Dermal Contact with Surface Water	25	ug/L				
3,3'-Dichlorobenzidine	Dermal Contact with Surface Water	10	ug/L	2.07E-7		1.28E-7	
3-Nitroaniline	Dermal Contact with Surface Water	25	ug/L				
4-Chloroaniline	Dermal Contact with Surface Water	10	ug/L				
4-Nitroaniline	Dermal Contact with Surface Water	25	ug/L				
Benzo(a)anthracene	Dermal Contact with Surface Water	5	ug/L	8.49E-6		5.23E-6	
Benzo(a)pyrene	Dermal Contact with Surface Water	5	ug/L	1.34E-4		8.23E-5	
Benzo(b)fluoranthene	Dermal Contact with Surface Water	5	ug/L	1.26E-5		7.74E-6	
Benzo(k)fluoranthene	Dermal Contact with Surface Water	5	ug/L				
Chrysene	Dermal Contact with Surface Water	5	ug/L	8.29E-8		5.11E-8	
Dibenzo(a,h)anthracene	Dermal Contact with Surface Water	5	ug/L				
Dibenzofuran	Dermal Contact with Surface Water	5	ug/L				
Hexachlorobenzene	Dermal Contact with Surface Water	5	ug/L				
Hexachlorobutadiene	Dermal Contact with Surface Water	5	ug/L				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Surface Water	5	ug/L				
N-Nitrosodi-n-propylamine	Dermal Contact with Surface Water	5	ug/L				
Pentachlorophenol	Dermal Contact with Surface Water	25	ug/L				
bis(2-Chloroethyl)ether	Dermal Contact with Surface Water	5	ug/L				
bis(2-Ethylhexyl)Phthalate	Dermal Contact with Surface Water	5	ug/L				
Benzene	Dermal Contact with Surface Water	0.5	ug/L				
2,4-Dinitrotoluene	Ingestion of Soil	0.185	mg/kg	7.60E-11	2.17E-7	2.36E-10	2.03E-6
2,6-Dinitrotoluene	Ingestion of Soil	0.185	mg/kg	7.60E-11	4.34E-7	2.36E-10	4.05E-6
3,3'-Dichlorobenzidine	Ingestion of Soil	0.37	mg/kg	1.01E-10		3.13E-10	
Benzo(a)anthracene	Ingestion of Soil	0.185	mg/kg	8.16E-11		2.54E-10	
Benzo(a)pyrene	Ingestion of Soil	0.185	mg/kg	8.16E-10		2.54E-9	
Benzo(b)fluoranthene	Ingestion of Soil	0.185	mg/kg	8.16E-11		2.54E-10	
Benzo(k)fluoranthene	Ingestion of Soil	0.185	mg/kg	8.16E-12		2.54E-11	
Chrysene	Ingestion of Soil	0.185	mg/kg	8.16E-13		2.54E-12	
Dibenzo(a,h)anthracene	Ingestion of Soil	0.185	mg/kg	8.16E-10		2.54E-9	

Table 3-33. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Airstrip Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Hexachlorobenzene	Ingestion of Soil	0.185	mg/kg	1.79E-10	5.43E-7	5.56E-10	5.07E-6
Indeno(1,2,3-c,d)pyrene	Ingestion of Soil	0.185	mg/kg	8.16E-11		2.54E-10	
N-Nitrosodi-n-propylamine	Ingestion of Soil	0.185	mg/kg	7.82E-10		2.43E-9	
Pentachlorophenol	Ingestion of Soil	0.9	mg/kg	6.52E-11	7.05E-8	2.03E-10	6.58E-7
bis(2-Chloroethyl)ether	Ingestion of Soil	0.185	mg/kg	1.12E-10		3.48E-10	
Aldrin	Ingestion of Sediment	0.001	mg/kg	1.03E-11	7.83E-8	3.19E-11	7.31E-7
Aroclor 1016	Ingestion of Sediment	0.0215	mg/kg	1.00E-10	7.21E-7	3.11E-10	6.73E-6
Aroclor 1221	Ingestion of Sediment	0.0435	mg/kg	2.02E-10	1.46E-6	6.29E-10	1.36E-5
Aroclor 1232	Ingestion of Sediment	0.0215	mg/kg	1.00E-10	7.21E-7	3.11E-10	6.73E-6
Aroclor 1242	Ingestion of Sediment	0.0215	mg/kg	1.00E-10	7.21E-7	3.11E-10	6.73E-6
Aroclor 1248	Ingestion of Sediment	0.0215	mg/kg	1.00E-10	7.21E-7	3.11E-10	6.73E-6
Aroclor 1254	Ingestion of Sediment	0.0215	mg/kg	1.00E-10	2.52E-6	3.11E-10	2.36E-5
Aroclor 1260	Ingestion of Sediment	0.0215	mg/kg	1.00E-10	7.21E-7	3.11E-10	6.73E-6
Dieldrin	Ingestion of Sediment	0.002	mg/kg	1.93E-11	9.39E-8	6.01E-11	8.77E-7
Heptachlor	Ingestion of Sediment	0.001	mg/kg	2.72E-12	4.70E-9	8.45E-12	4.38E-8
Heptachlor Epoxide	Ingestion of Sediment	0.001	mg/kg	5.50E-12	1.81E-7	1.71E-11	1.69E-6
Toxaphene	Ingestion of Sediment	0.11	mg/kg	7.31E-11		2.27E-10	
alpha-BHC	Ingestion of Sediment	0.001	mg/kg	3.80E-12		1.18E-11	
alpha-Chlordane	Ingestion of Sediment	0.001	mg/kg	7.85E-13	3.91E-8	2.44E-12	3.65E-7
gamma-Chlordane	Ingestion of Sediment	0.001	mg/kg	7.85E-13	3.91E-8	2.44E-12	3.65E-7
2,4-Dinitrotoluene	Ingestion of Sediment	0.215	mg/kg	8.83E-11	2.52E-7	2.75E-10	2.36E-6
2,6-Dinitrotoluene	Ingestion of Sediment	0.215	mg/kg	8.83E-11	5.05E-7	2.75E-10	4.71E-6
2-Nitroaniline	Ingestion of Sediment	1.05	mg/kg		4.11E-5		3.84E-4
3,3'-Dichlorobenzidine	Ingestion of Sediment	0.43	mg/kg	1.17E-10		3.64E-10	
Benzo(a)anthracene	Ingestion of Sediment	0.215	mg/kg	9.48E-11		2.95E-10	
Benzo(a)pyrene	Ingestion of Sediment	0.215	mg/kg	9.48E-10		2.95E-9	
Benzo(b)fluoranthene	Ingestion of Sediment	0.215	mg/kg	9.48E-11		2.95E-10	
Benzo(k)fluoranthene	Ingestion of Sediment	0.215	mg/kg	9.48E-12		2.95E-11	
Chrysene	Ingestion of Sediment	0.215	mg/kg	9.48E-13		2.95E-12	

Table 3-33. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the Airstrip Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Dibenzo(a,h)anthracene	Ingestion of Sediment	0.215	mg/kg	9.48E-10		2.95E-9	
Hexachlorobenzene	Ingestion of Sediment	0.215	mg/kg	2.08E-10	6.31E-7	6.46E-10	5.89E-6
Indeno(1,2,3-c,d)pyrene	Ingestion of Sediment	0.215	mg/kg	9.48E-11		2.95E-10	
N-Nitrosodi-n-propylamine	Ingestion of Sediment	0.215	mg/kg	9.09E-10		2.83E-9	
Pentachlorophenol	Ingestion of Sediment	1.05	mg/kg	7.61E-11	8.22E-8	2.37E-10	7.67E-7
bis(2-Chloroethyl)ether	Ingestion of Sediment	0.215	mg/kg	1.30E-10		4.04E-10	

Table 3-34. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the DP 011b Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Aldrin	Dermal Contact with Soil	0.095	mg/kg	1.18E-6	9.01E-3	7.28E-7	1.67E-2
Aroclor 1016	Dermal Contact with Soil	1.85	mg/kg	5.79E-6	4.18E-2	3.57E-6	7.72E-2
Aroclor 1221	Dermal Contact with Soil	3.7	mg/kg	1.16E-5	8.36E-2	7.14E-6	1.54E-1
Aroclor 1232	Dermal Contact with Soil	1.85	mg/kg	5.79E-6	4.18E-2	3.57E-6	7.72E-2
Aroclor 1242	Dermal Contact with Soil	1.85	mg/kg	5.79E-6	4.18E-2	3.57E-6	7.72E-2
Aroclor 1248	Dermal Contact with Soil	1.85	mg/kg	5.79E-6	4.18E-2	3.57E-6	7.72E-2
Aroclor 1254	Dermal Contact with Soil	1.85	mg/kg	5.79E-6	1.46E-1	3.57E-6	2.70E-1
Aroclor 1260	Dermal Contact with Soil	1.85	mg/kg	5.79E-6	4.18E-2	3.57E-6	7.72E-2
Dieldrin	Dermal Contact with Soil	0.185	mg/kg	2.17E-6	1.05E-2	1.33E-6	1.95E-2
Heptachlor	Dermal Contact with Soil	0.095	mg/kg				
Heptachlor Epoxide	Dermal Contact with Soil	0.095	mg/kg	4.79E-7	1.58E-2	2.95E-7	2.91E-2
Toxaphene	Dermal Contact with Soil	9.5	mg/kg				
alpha-BHC	Dermal Contact with Soil	0.095	mg/kg	2.26E-7		1.39E-7	
beta-BHC	Dermal Contact with Soil	0.095	mg/kg	6.88E-8		4.24E-8	
gamma-BHC	Dermal Contact with Soil	0.095	mg/kg		4.55E-4		8.41E-4
alpha-Chlordane	Dermal Contact with Soil	0.095	mg/kg	5.65E-8	2.82E-3	3.48E-8	5.21E-3
gamma-Chlordane	Dermal Contact with Soil	0.095	mg/kg	5.65E-8	2.82E-3	3.48E-8	5.21E-3
2,4-Dinitrotoluene	Dermal Contact with Soil	18.5	mg/kg	3.41E-6	9.75E-3	2.10E-6	1.80E-2
2,6-Dinitrotoluene	Dermal Contact with Soil	18.5	mg/kg	3.41E-6	1.95E-2	2.10E-6	3.60E-2
2,4-Dinitrophenol	Dermal Contact with Soil	95	mg/kg				
2,4,6-Trichlorophenol	Dermal Contact with Soil	18.5	mg/kg				
1,4-Dichlorobenzene	Dermal Contact with Soil	18.5	mg/kg				
2-Nitroaniline	Dermal Contact with Soil	95	mg/kg				
3-Nitroaniline	Dermal Contact with Soil	95	mg/kg				
4-Nitroaniline	Dermal Contact with Soil	95	mg/kg				
3,3'-Dichlorobenzidine	Dermal Contact with Soil	37	mg/kg	4.51E-6		2.78E-6	
Benzo(a)anthracene	Dermal Contact with Soil	18.5	mg/kg	5.81E-6		3.58E-6	
Benzo(a)pyrene	Dermal Contact with Soil	18.5	mg/kg	6.18E-5		3.81E-5	
Benzo(b)fluoranthene	Dermal Contact with Soil	18.5	mg/kg	5.81E-6		3.58E-6	
Benzo(k)fluoranthene	Dermal Contact with Soil	18.5	mg/kg				
Chrysene	Dermal Contact with Soil	18.5	mg/kg	5.68E-8		3.50E-8	
Dibenzo(a,h)anthracene	Dermal Contact with Soil	18.5	mg/kg				

Table 3-34. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the DP 011b Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Dibenzofuran	Dermal Contact with Soil	18.5	mg/kg				
Hexachlorobenzene	Dermal Contact with Soil	18.5	mg/kg				
Hexachlorobutadiene	Dermal Contact with Soil	18.5	mg/kg				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Soil	18.5	mg/kg				
N-Nitrosodi-n-propylamine	Dermal Contact with Soil	18.5	mg/kg	4.05E-5		2.50E-5	
N-Nitrosodiphenylamine	Dermal Contact with Soil	18.5	mg/kg	2.26E-8		1.39E-8	
Pentachlorophenol	Dermal Contact with Soil	95	mg/kg				
bis(2-Ethylhexyl)phthalate	Dermal Contact with Soil	18.5	mg/kg	1.15E-7	1.60E-3	7.08E-8	2.95E-3
bis(2-Chloroethyl)ether	Dermal Contact with Soil	18.5	mg/kg				
Aldrin	Ingestion of Soil	0.095	mg/kg	9.75E-10	7.44E-6	3.03E-9	6.94E-5
Aroclor 1016	Ingestion of Soil	1.85	mg/kg	8.60E-9	6.21E-5	2.68E-8	5.79E-4
Aroclor 1221	Ingestion of Soil	3.7	mg/kg	1.72E-8	1.24E-4	5.35E-8	1.16E-3
Aroclor 1232	Ingestion of Soil	1.85	mg/kg	8.60E-9	6.21E-5	2.68E-8	5.79E-4
Aroclor 1242	Ingestion of Soil	1.85	mg/kg	8.60E-9	6.21E-5	2.68E-8	5.79E-4
Aroclor 1248	Ingestion of Soil	1.85	mg/kg	8.60E-9	6.21E-5	2.68E-8	5.79E-4
Aroclor 1254	Ingestion of Soil	1.85	mg/kg	8.60E-9	2.17E-4	2.68E-8	2.03E-3
Aroclor 1260	Ingestion of Soil	1.85	mg/kg	8.60E-9	6.21E-5	2.68E-8	5.79E-4
Dieldrin	Ingestion of Soil	0.185	mg/kg	1.79E-9	8.69E-6	5.56E-9	8.11E-5
Heptachlor	Ingestion of Soil	0.095	mg/kg	2.58E-10	4.46E-7	8.03E-10	4.16E-6
Heptachlor Epoxide	Ingestion of Soil	0.095	mg/kg	5.22E-10	1.72E-5	1.62E-9	1.60E-4
Toxaphene	Ingestion of Soil	9.5	mg/kg	6.31E-9		1.96E-8	
alpha-BHC	Ingestion of Soil	0.095	mg/kg	3.61E-10		1.12E-9	
beta-BHC	Ingestion of Soil	0.095	mg/kg	1.03E-10		3.21E-10	
gamma-BHC	Ingestion of Soil	0.095	mg/kg		7.44E-7		6.94E-6
alpha-Chlordane	Ingestion of Soil	0.095	mg/kg	7.46E-11	3.72E-6	2.32E-10	3.47E-5
gamma-Chlordane	Ingestion of Soil	0.095	mg/kg	7.46E-11	3.72E-6	2.32E-10	3.47E-5
2,4-Dinitrotoluene	Ingestion of Soil	18.5	mg/kg	7.60E-9	2.17E-5	2.36E-8	2.03E-4
2,6-Dinitrotoluene	Ingestion of Soil	18.5	mg/kg	7.60E-9	4.34E-5	2.36E-8	4.05E-4
2,4-Dinitrophenol	Ingestion of Soil	95	mg/kg				
2,4,6-Trichlorophenol	Ingestion of Soil	18.5	mg/kg	1.23E-10		3.82E-10	

Table 3-34. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs at the DP 011b Area Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
1,4-Dichlorobenzene	Ingestion of Soil	18.5	mg/kg				
2-Nitroaniline	Ingestion of Soil	95	mg/kg		3.72E-3		3.47E-2
3-Nitroaniline	Ingestion of Soil	95	mg/kg		7.44E-5		6.94E-4
4-Nitroaniline	Ingestion of Soil	95	mg/kg		7.44E-5		6.94E-4
3,3'-Dichlorobenzidine	Ingestion of Soil	37	mg/kg	1.01E-8		3.13E-8	
Benzo(a)anthracene	Ingestion of Soil	18.5	mg/kg	8.16E-9		2.54E-8	
Benzo(a)pyrene	Ingestion of Soil	18.5	mg/kg	8.16E-8		2.54E-7	
Benzo(b)fluoranthene	Ingestion of Soil	18.5	mg/kg	8.16E-9		2.54E-8	
Benzo(k)fluoranthene	Ingestion of Soil	18.5	mg/kg	8.16E-10		2.54E-9	
Chrysene	Ingestion of Soil	18.5	mg/kg	8.16E-11		2.54E-10	
Dibenzo(a,h)anthracene	Ingestion of Soil	18.5	mg/kg	8.16E-8		2.54E-7	
Dibenzofuran	Ingestion of Soil	18.5	mg/kg		1.09E-5		1.01E-4
Hexachlorobenzene	Ingestion of Soil	18.5	mg/kg	1.79E-8	5.43E-5	5.56E-8	5.07E-4
Hexachlorobutadiene	Ingestion of Soil	18.5	mg/kg	8.71E-10		2.71E-9	
Indeno(1,2,3-c,d)pyrene	Ingestion of Soil	18.5	mg/kg	8.16E-9		2.54E-8	
N-Nitrosodi-n-propylamine	Ingestion of Soil	18.5	mg/kg	7.82E-8		2.43E-7	
N-Nitrosodiphenylamine	Ingestion of Soil	18.5	mg/kg	5.47E-11		1.70E-10	
Pentachlorophenol	Ingestion of Soil	95	mg/kg	6.88E-9	7.44E-6	2.14E-8	6.94E-5
bis(2-Ethylhexyl)phthalate	Ingestion of Soil	18.5	mg/kg	1.56E-10	2.17E-6	4.87E-10	2.03E-5
bis(2-Chloroethyl)ether	Ingestion of Soil	18.5	mg/kg	1.12E-8		3.48E-8	

Table 3-35. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs due to Inhalation at Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Aldrin	Inhalation of Dust	1.03821E-09	mg/m3	2.13E-10		1.99E-10	
Aroclor 1016	Inhalation of Dust	3.825E-09	mg/m3				
Aroclor 1221	Inhalation of Dust	7.65E-09	mg/m3				
Aroclor 1232	Inhalation of Dust	3.825E-09	mg/m3				
Aroclor 1248	Inhalation of Dust	3.825E-09	mg/m3				
Dieldrin	Inhalation of Dust	2.02179E-09	mg/m3	3.91E-10		3.65E-10	
Heptachlor	Inhalation of Dust	1.03821E-09	mg/m3	1.63E-14		1.52E-14	
Heptachlor epoxide	Inhalation of Dust	1.03821E-09	mg/m3	1.14E-10		1.06E-10	
Toxaphene	Inhalation of Dust	1.03821E-07	mg/m3	1.38E-9		1.29E-9	
Chlordane, alpha	Inhalation of Dust	1.03821E-09	mg/m3	1.62E-11		1.51E-11	
Chlordane, gamma	Inhalation of Dust	1.03821E-09	mg/m3	1.62E-11		1.51E-11	
1,4-Dichlorobenzene	Inhalation of Dust	2.24473E-05	mg/m3		4.60E-6		1.29E-5
2-Nitroaniline	Inhalation of Dust	0.00011527	mg/m3		9.48E-2		2.65E-1
2,4-Dinitrotoluene	Inhalation of Dust	2.12339E-07	mg/m3				
2,6-Dinitrotoluene	Inhalation of Dust	2.12339E-07	mg/m3				
3,3'-Dichlorobenzidine	Inhalation of Dust	4.18612E-07	mg/m3				
Benzo(a)anthracene	Inhalation of Dust	2.12339E-07	mg/m3				
Benzo(a)pyrene	Inhalation of Dust	2.12339E-07	mg/m3				
Benzo(b)fluoranthene	Inhalation of Dust	2.12339E-07	mg/m3				
Benzo(k)fluoranthene	Inhalation of Dust	2.12339E-07	mg/m3				
Chrysene	Inhalation of Dust	2.12339E-07	mg/m3				
Dibenzo(a,h)anthracene	Inhalation of Dust	2.12339E-07	mg/m3				
Hexachlorobenzene	Inhalation of Dust	2.12339E-07	mg/m3				
Indeno(1,2,3-c,d)pyrene	Inhalation of Dust	2.12339E-07	mg/m3				
N-Nitrosodi-n-propylamine	Inhalation of Dust	2.12339E-07	mg/m3				
Pentachlorophenol	Inhalation of Dust	1.03136E-06	mg/m3				
bis(2-Chloroethyl)ether	Inhalation of Dust	2.12339E-07	mg/m3				

Table 3-36. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs in Background Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Aldrin	Dermal Contact with Soil	0.001	mg/kg	1.24E-8	9.49E-5	7.66E-9	1.75E-4
Aroclor 1016	Dermal Contact with Soil	0.0175	mg/kg	5.48E-8	3.95E-4	3.38E-8	7.31E-4
Aroclor 1221	Dermal Contact with Soil	0.036	mg/kg	1.13E-7	8.13E-4	6.94E-8	1.50E-3
Aroclor 1232	Dermal Contact with Soil	0.0175	mg/kg	5.48E-8	3.95E-4	3.38E-8	7.31E-4
Aroclor 1242	Dermal Contact with Soil	0.0175	mg/kg	5.48E-8	3.95E-4	3.38E-8	7.31E-4
Aroclor 1248	Dermal Contact with Soil	0.0175	mg/kg	5.48E-8	3.95E-4	3.38E-8	7.31E-4
Aroclor 1260	Dermal Contact with Soil	0.0175	mg/kg	5.48E-8	3.95E-4	3.38E-8	7.31E-4
Toxaphene	Dermal Contact with Soil	0.09	mg/kg				
2,4-Dinitrotoluene	Dermal Contact with Soil	0.175	mg/kg	3.23E-8	9.22E-5	1.99E-8	1.70E-4
2,6-Dinitrotoluene	Dermal Contact with Soil	0.175	mg/kg	3.23E-8	1.84E-4	1.99E-8	3.41E-4
3,3'-Dichlorobenzidine	Dermal Contact with Soil	0.355	mg/kg	4.33E-8		2.67E-8	
Benzo(a)anthracene	Dermal Contact with Soil	0.175	mg/kg	5.50E-8		3.39E-8	
Benzo(a)pyrene	Dermal Contact with Soil	0.175	mg/kg	5.84E-7		3.60E-7	
Benzo(b)fluoranthene	Dermal Contact with Soil	0.175	mg/kg	5.50E-8		3.39E-8	
Benzo(k)fluoranthene	Dermal Contact with Soil	0.175	mg/kg				
Chrysene	Dermal Contact with Soil	0.175	mg/kg	5.37E-10		3.31E-10	
Dibenzo(a,h)anthracene	Dermal Contact with Soil	0.175	mg/kg				
Hexachlorobenzene	Dermal Contact with Soil	0.175	mg/kg				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Soil	0.175	mg/kg				
N-Nitrosodi-n-propylamine	Dermal Contact with Soil	0.175	mg/kg	3.83E-7		2.36E-7	
Pentachlorophenol	Dermal Contact with Soil	0.85	mg/kg				
bis(2-Chloroethyl)ether	Dermal Contact with Soil	0.175	mg/kg				
Aldrin	Dermal Contact with Surface Water	0.0125	ug/L	1.66E-9	1.26E-5	1.02E-9	2.34E-5
Aroclor 1016	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1221	Dermal Contact with Surface Water	0.5	ug/L				
Aroclor 1232	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1242	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1248	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1254	Dermal Contact with Surface Water	0.25	ug/L				
Aroclor 1260	Dermal Contact with Surface Water	0.25	ug/L				
Dieldrin	Dermal Contact with Surface Water	0.025	ug/L	3.12E-8	1.52E-4	1.92E-8	2.81E-4
Heptachlor	Dermal Contact with Surface Water	0.0125	ug/L				

Table 3-36. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs in Background Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Heptachlor Epoxide	Dermal Contact with Surface Water	0.0125	ug/L				
Toxaphene	Dermal Contact with Surface Water	1.25	ug/L				
alpha-BHC	Dermal Contact with Surface Water	0.0125	ug/L				
alpha-Chlordane	Dermal Contact with Surface Water	0.25	ug/L	5.15E-8	2.57E-3	3.17E-8	4.75E-3
gamma-Chlordane	Dermal Contact with Surface Water	0.25	ug/L	5.15E-8	2.57E-3	3.17E-8	4.75E-3
1,2,4-Trichlorobenzene	Dermal Contact with Surface Water	5	ug/L				
1,4-Dichlorobenzene	Dermal Contact with Surface Water	5	ug/L				
2,2'-Oxybis(1-chloropropane)	Dermal Contact with Surface Water	5	ug/L				
2,4,6-Trichlorophenol	Dermal Contact with Surface Water	5	ug/L				
2,4-Dinitrophenol	Dermal Contact with Surface Water	5	ug/L				
2,4-Dinitrotoluene	Dermal Contact with Surface Water	5	ug/L	3.50E-8	1.00E-4	2.16E-8	1.85E-4
2,6-Dinitrotoluene	Dermal Contact with Surface Water	5	ug/L	2.30E-8	1.32E-4	1.42E-8	2.44E-4
2-Nitroaniline	Dermal Contact with Surface Water	5	ug/L				
3,3'-Dichlorobenzidine	Dermal Contact with Surface Water	5	ug/L	1.04E-7		6.39E-8	
3-Nitroaniline	Dermal Contact with Surface Water	5	ug/L				
4-Chloroaniline	Dermal Contact with Surface Water	5	ug/L				
4-Nitroaniline	Dermal Contact with Surface Water	5	ug/L				
Benzo(a)anthracene	Dermal Contact with Surface Water	5	ug/L	8.49E-6		5.23E-6	
Benzo(a)pyrene	Dermal Contact with Surface Water	5	ug/L	1.34E-4		8.23E-5	
Benzo(b)fluoranthene	Dermal Contact with Surface Water	5	ug/L	1.26E-5		7.74E-6	
Benzo(k)fluoranthene	Dermal Contact with Surface Water	5	ug/L				
Chrysene	Dermal Contact with Surface Water	5	ug/L	8.29E-8		5.11E-8	
Dibenzo(a,h)anthracene	Dermal Contact with Surface Water	5	ug/L				
Dibenzofuran	Dermal Contact with Surface Water	5	ug/L				
Hexachlorobenzene	Dermal Contact with Surface Water	5	ug/L				
Hexachlorobutadiene	Dermal Contact with Surface Water	5	ug/L				
Indeno(1,2,3-c,d)pyrene	Dermal Contact with Surface Water	5	ug/L				
N-Nitrosodi-n-propylamine	Dermal Contact with Surface Water	5	ug/L				
Pentachlorophenol	Dermal Contact with Surface Water	5	ug/L				
bis(2-Chloroethyl)ether	Dermal Contact with Surface Water	5	ug/L				
bis(2-Ethylhexyl)Phthalate	Dermal Contact with Surface Water	5	ug/L				
1,1,2,2-Tetrachloroethane	Dermal Contact with Surface Water	0.5	ug/L				

Table 3-36. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs in Background Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
1,1,2-Trichloroethane	Dermal Contact with Surface Water	0.5	ug/L	5.84E-10	9.96E-6	3.60E-10	1.84E-5
1,1-Dichloroethene	Dermal Contact with Surface Water	0.5	ug/L				
1,2-Dichloroethane	Dermal Contact with Surface Water	0.5	ug/L	5.88E-10		3.62E-10	
Benzene	Dermal Contact with Surface Water	0.5	ug/L				
Bromodichloromethane	Dermal Contact with Surface Water	0.5	ug/L				
Carbon tetrachloride	Dermal Contact with Surface Water	0.5	ug/L				
Chloroform	Dermal Contact with Surface Water	0.5	ug/L				
Vinyl chloride	Dermal Contact with Surface Water	0.5	ug/L	5.64E-7		3.47E-7	
cis-1,3-Dichloropropene	Dermal Contact with Surface Water	0.5	ug/L				
trans-1,3-Dichloropropene	Dermal Contact with Surface Water	0.5	ug/L				
Aldrin	Ingestion of Soil	0.001	mg/kg	1.03E-11	7.83E-8	3.19E-11	7.31E-7
Aroclor 1016	Ingestion of Soil	0.0175	mg/kg	8.14E-11	5.87E-7	2.53E-10	5.48E-6
Aroclor 1221	Ingestion of Soil	0.036	mg/kg	1.67E-10	1.21E-6	5.21E-10	1.13E-5
Aroclor 1232	Ingestion of Soil	0.0175	mg/kg	8.14E-11	5.87E-7	2.53E-10	5.48E-6
Aroclor 1242	Ingestion of Soil	0.0175	mg/kg	8.14E-11	5.87E-7	2.53E-10	5.48E-6
Aroclor 1248	Ingestion of Soil	0.0175	mg/kg	8.14E-11	5.87E-7	2.53E-10	5.48E-6
Aroclor 1260	Ingestion of Soil	0.0175	mg/kg	8.14E-11	5.87E-7	2.53E-10	5.48E-6
Toxaphene	Ingestion of Soil	0.09	mg/kg	5.98E-11		1.86E-10	
2,4-Dinitrotoluene	Ingestion of Soil	0.175	mg/kg	7.19E-11	2.05E-7	2.24E-10	1.92E-6
2,6-Dinitrotoluene	Ingestion of Soil	0.175	mg/kg	7.19E-11	4.11E-7	2.24E-10	3.84E-6
3,3'-Dichlorobenzidine	Ingestion of Soil	0.355	mg/kg	9.65E-11		3.00E-10	
Benzo(a)anthracene	Ingestion of Soil	0.175	mg/kg	7.71E-11		2.40E-10	
Benzo(a)pyrene	Ingestion of Soil	0.175	mg/kg	7.71E-10		2.40E-9	
Benzo(b)fluoranthene	Ingestion of Soil	0.175	mg/kg	7.71E-11		2.40E-10	
Benzo(k)fluoranthene	Ingestion of Soil	0.175	mg/kg	7.71E-12		2.40E-11	
Chrysene	Ingestion of Soil	0.175	mg/kg	7.71E-13		2.40E-12	
Dibenzo(a,h)anthracene	Ingestion of Soil	0.175	mg/kg	7.71E-10		2.40E-9	
Hexachlorobenzene	Ingestion of Soil	0.175	mg/kg	1.69E-10	5.14E-7	5.26E-10	4.79E-6
Indeno(1,2,3-c,d)pyrene	Ingestion of Soil	0.175	mg/kg	7.71E-11		2.40E-10	
N-Nitrosodi-n-propylamine	Ingestion of Soil	0.175	mg/kg	7.40E-10		2.30E-9	

Table 3-36. Carcinogenic and Non-carcinogenic Risks for Non-Detected COPCs in Background Tin City LRRS

ANALYTE	EXPOSURE PATHWAY	EXPOSURE POINT CONCENTRATION	UNITS	ADULT CANCER RISK	ADULT HAZARD INDEX	CHILD CANCER RISK	CHILD HAZARD INDEX
Pentachlorophenol	Ingestion of Soil	0.85	mg/kg	6.16E-11	6.65E-8	1.92E-10	6.21E-7
bis(2-Chloroethyl)ether	Ingestion of Soil	0.175	mg/kg	1.06E-10		3.29E-10	
Aldrin	Inhalation of Dust	1.03821E-09	mg/m3	2.13E-10		1.99E-10	
Aroclor 1016	Inhalation of Dust	3.825E-09	mg/m3				
Aroclor 1221	Inhalation of Dust	7.65E-09	mg/m3				
Aroclor 1232	Inhalation of Dust	3.825E-09	mg/m3				
Aroclor 1248	Inhalation of Dust	3.825E-09	mg/m3				
Dieldrin	Inhalation of Dust	2.02179E-09	mg/m3	3.91E-10		3.65E-10	
Heptachlor	Inhalation of Dust	1.03821E-09	mg/m3	1.63E-14		1.52E-14	
Heptachlor epoxide	Inhalation of Dust	1.03821E-09	mg/m3	1.14E-10		1.06E-10	
Toxaphene	Inhalation of Dust	1.03821E-07	mg/m3	1.38E-9		1.29E-9	
Chlordane, alpha	Inhalation of Dust	1.03821E-09	mg/m3	1.62E-11		1.51E-11	
Chlordane, gamma	Inhalation of Dust	1.03821E-09	mg/m3	1.62E-11		1.51E-11	
1,4-Dichlorobenzene	Inhalation of Dust	2.24473E-05	mg/m3		4.60E-6		1.29E-5
2-Nitroaniline	Inhalation of Dust	0.00011527	mg/m3		9.48E-2		2.65E-1
2,4-Dinitrotoluene	Inhalation of Dust	2.12339E-07	mg/m3				
2,6-Dinitrotoluene	Inhalation of Dust	2.12339E-07	mg/m3				
3,3'-Dichlorobenzidine	Inhalation of Dust	4.18612E-07	mg/m3				
Benzo(a)anthracene	Inhalation of Dust	2.12339E-07	mg/m3				
Benzo(a)pyrene	Inhalation of Dust	2.12339E-07	mg/m3				
Benzo(b)fluoranthene	Inhalation of Dust	2.12339E-07	mg/m3				
Benzo(k)fluoranthene	Inhalation of Dust	2.12339E-07	mg/m3				
Chrysene	Inhalation of Dust	2.12339E-07	mg/m3				
Dibenzo(a,h)anthracene	Inhalation of Dust	2.12339E-07	mg/m3				
Hexachlorobenzene	Inhalation of Dust	2.12339E-07	mg/m3				
Indeno(1,2,3-c,d)pyrene	Inhalation of Dust	2.12339E-07	mg/m3				
N-Nitrosodi-n-propylamine	Inhalation of Dust	2.12339E-07	mg/m3				
Pentachlorophenol	Inhalation of Dust	1.03136E-06	mg/m3				
bis(2-Chloroethyl)ether	Inhalation of Dust	2.12339E-07	mg/m3				

TABLE 3-37. ESTIMATED RISK DUE TO DUST INHALATION				
	ADULT EXPOSURE		CHILD EXPOSURE	
	Carcinogenic Risk	Non-Carcinogenic Risk	Carcinogenic Risk	Non-Carcinogenic Risk
DETECTED COPCs				
IRP	0.00E+0	0.00	0.00E+0	0.00
Background	2.03E-9	0.00	1.89E-9	0.00
NON-DETECTED COPCs				
IRP	2.13E-9	0.09	1.99E-9	0.27
Background	3.01E-9	0.00	2.81E-9	0.01

TABLE 3-38. ESTIMATED RISK FROM INGESTION OF SOIL/SEDIMENT				
	ADULT EXPOSURE		CHILD EXPOSURE	
	Carcinogenic Risk	Non-Carcinogenic Risk	Carcinogenic Risk	Non-Carcinogenic Risk
DETECTED COPCs				
Ingestion of Soil				
Beach Area (except DP 011b)	0.00E+0	0.00	0.00E+0	0.00
Lower Camp, Tramway and Top Camp	2.46E-8	0.00	7.65E-8	0.00
Airstrip	0.00E+0	0.00	0.00E+0	0.00
DP 011b	0.00E+0	0.00	0.00E+0	0.00
Background	2.20E-9	0.00	6.85E-9	0.00
Ingestion of Sediment				
Beach Area (except DP 011b)	7.93E-9	0.00	2.47E-8	0.00
Airstrip	0.00E+0	0.00	0.00E+0	0.00
NON-DETECTED COPCs				
Ingestion of Soil				
Beach Area (except DP 011b)	3.28E-9	0.00	1.02E-8	0.00
Lower Camp, Tramway and Top Camp	1.27E-8	0.00	3.94E-8	0.00
Airstrip	3.27E-9	0.00	1.02E-8	0.00
DP 011b	4.08E-7	0.00	1.27E-6	0.04
Background	3.73E-9	0.00	1.16E-8	0.00
Ingestion of Sediment				
Beach Area (except DP 011b)	9.48E-9	0.00	2.95E-8	0.00
Airstrip	4.72E-9	0.00	1.47E-8	0.00

TABLE 3-39. ESTIMATED RISK FROM DERMAL CONTACT WITH SOIL/SEDIMENT				
	ADULT EXPOSURE		CHILD EXPOSURE	
	Carcinogenic Risk	Non-Carcinogenic Risk	Carcinogenic Risk	Non-Carcinogenic Risk
DETECTED COPCs				
Dermal Contact with Soil				
Beach Area (except DP 011b)	0.00E+0	0.00	0.00E+0	0.00
Lower Camp, Tramway and Top Camp	1.66E-5	0.19	1.02E-5	0.36
Airstrip	0.00E+0	0.00	0.00E+0	0.00
DP 011b	0.00E+0	0.00	0.00E+0	0.00
Background	9.71E-7	0.02	5.98E-7	0.05
Dermal Contact with Sediment				
Beach Area (except DP 011b)	0.00E+0	0.00	0.00E+0	0.00
Airstrip	0.00E+0	0.00	0.00E+0	0.00
NON-DETECTED COPCs				
Dermal Contact with Soil				
Beach Area (except DP 011b)	1.25E-6	0.00	7.72E-7	0.00
Lower Camp, Tramway and Top Camp	6.89E-6	0.04	4.24E-6	0.08
Airstrip	1.25E-6	0.00	7.72E-7	0.00
DP 011b	1.76E-4	0.51	1.08E-4	0.94
Background	1.58E-6	0.00	9.76E-7	0.01
Dermal Contact with Sediment				
Beach Area (except DP 011b)	4.95E-6	0.03	3.05E-6	0.06
Airstrip	2.04E-6	0.01	1.26E-6	0.01

TABLE 3-40. ESTIMATED RISK FROM DERMAL CONTACT WITH SOIL

Location	Receptor	Chemical	Risk Type	Soil Concentration (mg/kg)	Intake Factor (mg/kg·day)	Oral SF $(mg/kg \cdot day)^{-1}$	Cancer Risk (Dose x SF)
ADULT RISKS							
Soil							
Lower Camp, Tramway, and Top Camp	Adult	Aroclor 1242	Carcinogenic	3.2	1.17E-06	8.56	1.00E-05
Lower Camp, Tramway, and Top Camp	Adult	Aroclor 1254	Carcinogenic	1.3	4.76E-07	8.56	4.07E-06
Lower Camp, Tramway, and Top Camp	Adult	Aroclor 1260	Carcinogenic	0.79	2.89E-07	8.56	2.47E-06
CHILD RISKS							
Soil							
Lower Camp, Tramway, and Top Camp	Child	Aroclor 1242	Carcinogenic	3.2	7.21E-07	8.56	6.17E-06
Lower Camp, Tramway, and Top Camp	Child	Aroclor 1254	Carcinogenic	1.3	2.93E-07	8.56	2.51E-06
Lower Camp, Tramway, and Top Camp	Child	Aroclor 1260	Carcinogenic	0.79	1.78E-07	8.56	1.52E-06

TABLE 3-41. ESTIMATED RISK DUE TO DERMAL CONTACT WITH SURFACE WATER				
	ADULT EXPOSURE		CHILD EXPOSURE	
	Carcinogenic Risk	Non-Carcinogenic Risk	Carcinogenic Risk	Non-Carcinogenic Risk
DETECTED COPCs				
Dermal Contact with Surface Water				
Beach Area	0.00E+0	0.00	0.00E+0	0.00
Airstrip	0.00E+0	0.00	0.00E+0	0.00
Background	0.00E+0	0.00	0.00E+0	0.00
NON-DETECTED COPCs				
Dermal Contact with Surface Water				
Beach	1.56E-4	0.01	9.59E-5	0.01
Airstrip	1.56E-4	0.05	9.63E-5	0.10
Background	1.56E-4	0.01	9.58E-5	0.01

TABLE 3-42. SUMMARY OF COMBINED ESTIMATED RISK FOR ALL EXPOSURE PATHWAYS FOR EACH INVESTIGATIVE AREA				
	ADULT EXPOSURE		CHILD EXPOSURE	
	Carcinogenic Risk	Non-Carcinogenic Risk	Carcinogenic Risk	Non-Carcinogenic Risk
DETECTED COPCs				
Beach Area (except DP 011b)	7.93E-9	0.00	2.47E-8	0.00
Lower Camp, Tramway and Top Camp	1.66E-5	0.19	1.03E-5	0.36
Airstrip	0.00E+0	0.00	0.00E+0	0.00
DP 011b	0.00E+0	0.00	0.00E+0	0.00
Background	9.75E-7	0.02	6.07E-7	0.05
NON-DETECTED COPCs				
Beach (except DP 011b)	1.62E-4	0.13	9.98E-5	0.34
Lower Camp, Tramway and Top Camp	6.90E-6	0.13	4.28E-6	0.35
Airstrip	1.59E-4	0.15	9.84E-5	0.38
DP 011b	1.76E-4	0.60	1.09E-4	1.21
Background	1.58E-4	0.01	9.68E-5	0.03

TABLE 3-43. LOCATION OF HUMAN HEALTH COPCs WHICH EXCEED A 10E-6 RISK VALUE AT TIN CITY LRRS	
	EXPOSURE PATHWAY
Contaminant	Dermal Contact with soil
Aroclor 1242	AOC3
Aroclor 1254	AOC2, Background
Aroclor 1260	AOC2

Table 3-44. Risk-based Screening Concentration for Ecological Baseline Risk Assessment (Page 1 of 3)

Chemical	Surface Water RBC (μg/L)	Source	Soil/Sediment RBC (mg/kg)	Source
Metals				
Antimony			2	4
Arsenic	190	1	6	2
Berylium	5.3	1		
Cadmium	1.1	1	0.6	2
Chromium, total	11	1	26	2
Cobalt			50	2
Copper	12	1	16	2
Iron	1000	1	20000	2
Lead	3.2	1	31	2
Manganese			460	2
Mercury	0.012	1	0.15	4
Nickel	160	1	16	2
Selenium	5	1		
Silver	0.12	1	0.5	2
Thallium	40	1		
Zinc	110	1	120	2
Pesticides/PCBs				
4,4' -DDD	1050	1	0.002	4
4,4' -DDE	1050	1	0.002	4
4,4' -DDT	0.001	1	0.001	4
Aldrin	3	1	0.0306*	3
Aroclor 1016	0.014	1	0.007	2
Aroclor 1221	0.014	1		
Aroclor 1232	0.014	1		
Aroclor 1242	0.014	1		
Aroclor 1248	0.014	1	0.03	2
Aroclor 1254	0.014	1	0.06	2
Aroclor 1260	0.014	1	0.005	2
Dieldrin	0.0019	1	0.00002	4
Endosulfan I	0.056	1	0.001194*	3
Endosulfan II	0.056	1	0.001194*	3
Endrin	0.0023	1	0.00002	4
Heptachlor	0.0038	1	0.001194*	3
Heptachlor Epoxide	0.0038	1	0.001194*	3
Methoxychlor	0.03	1	0.02388*	3
Toxaphene	0.0002	1	0.000398*	3
alpha-Chlordane	0.0043	1	0.00024*	3
gamma BHC (Lindane)	0.08	1	0.002388*	3
gamma-Chlordane	0.0043	1	0.00024*	3
alpha BHC			0.002388*	3
beta BHC			0.002388*	3
delta BHC			0.002388*	3

Table 3-44. Risk-based Screening Concentration for Ecological Baseline Risk Assessment (Page 2 of 3)

Chemical	Surface Water RBC (µg/L)	Source	Soil/Sediment RBC (mg/kg)	Source
Semi-volatile Organics				
1,2,4-Trichlorobenzene	50	1	3.6218*	3
1,2-Dichlorobenzene	763	1	0.4776*	3
1,3-Dichlorobenzene	763	1	0.4776*	3
1,4-Dichlorobenzene	763	1	0.4776*	3
2,4,5-Trichlorophenol	63	1		
2,4,6-Trichlorophenol	970	1		
2,4-Dichlorophenol	365	1		
2,4-Dimethylphenol	2120	1		
2,4-Dinitrophenol	150	1		
2,4-Dinitrotoluene	230	1		
2-Chloroethyl Vinyl Ether	122	1		
2-Chloroaphthalene	1600	1		
2-Chlorophenol	4380	1		
2-Methylnaphthalene			0.065	4
2-Nitrophenol	150	1		
4-Bromophenyl Phenyl Ether	122	1		
4-Chloro-3-3Methylphenol	30	1		
4-Chlorophenyl Phenyl Ether	122	1		
4-Nitrophenol	150	1		
Acenaphthene	520	1	0.15	4
Anthracene			0.085	4
Benzo(a)anthracene			0.23	4
Benzo(a)pyrene			0.37	2
Benzo(b)fluoranthene			0.0517*	3
Benzo(g,h,i)perylene			0.17	2
Benzo(k)fluoranthene			0.0517*	3
bis(2-Ethylhexyl) Phthalate	360	1	7.9401*	3
Butylbenzylphthalate	3	1		
Chrysene			0.34	2
di-n-butyl Phthalate	3	1		
di-n-Octylphthalate	3	1		
Dibenzo(a,h)anthracene			0.06	4
Diethyl Phthalate	3	1		
Dimethyl Phthalate	3	1		
Fluoranthene	3980	1	0.6	4
Fluorene			0.035	4
Hexachlorobenzene	3.68	1	0.4476*	3
Hexchlorobutadiene	9.3	1	0.1592*	3
Hexachlorocyclopentadiene	5.2	1	0.17512*	3
Indeno(1,2,3-c,d)pyrene			0.2	2
Isophorone	117000	1		
Naphthalene	620	1	340	4
Pentachlorophenol	13	1	1.592*	3
Phenanthrene	6.3	1	0.225*	3
Phenol	2560	1		
Pyrene			0.35	4

Table 3-44. Risk-based Screening Concentration for Ecological Baseline Risk Assessment (Page 3 of 3)

Chemical	Ground Water RBC (µg/L)	Source	Soil/Sediment RBC (mg/kg)	Source
Volatile Organics				
1,1,1,2-Tetrachloroethane	9320	1		
1,1,1-Trichloroethane	18000	1		
1,1,2,2-Tetrachloroethane	2400	1	0.1592*	3
1,1,2-Trichloroethane	9400	1	0.24676*	3
1,1-Dichloroethene	11600	1	0.00398*	3
1,2-Dichloroethane	20000	1	0.1194*	3
1,2-Dichloropropane	5700	1		
Benzene	5300	1	0.02388*	3
Carbon Tetrachloride	35200	1	0.078008*	3
Chlorobenzene			0.1393*	3
Chloroform	1240	1		
cis-1,2-Dichloroethylene	11600	1		
cis-1,3-Dichloropropene	244	1		
Ethylbenzene	32000	1		
Hexachloroethane	540	1		
Nitrobenzene	27000	1		
Tetrachloroethylene (pce)	840	1	0.03184*	3
Toluene	17500	1		
trans-1,2-Dichloroethene	11600	1		
trans-1,3-Dichloropropene	244	1		
Trichloroethylene (tce)	21900	1	0.0796*	3
Vinyl Chloride			0.0796*	3

*Converted from original units (mg/kg OC) by using mean TOC value from Kotzebue LRRS (3.98%)

RBC = Risk-based concentration

Sources:

1 = U.S. EPA (1991d) Water Quality Criteria-Fresh Acute or Chronic

2 = Ontario Aquatic Sediment Quality Guidelines (Persaud et al. 1993)

3 = Sediment Criteria for New York State (Newell and Sinnott 1993)

4 = Adverse Effects to Benthic Organism in Sediment-Effects Range-Low (Long and Morgan 1990)

TABLE 3-45. CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN (COPEC) BY MEDIA AT TIN CITY LRRS, ALASKA (Page 1 of 2)

Chemical	Media		
	Sediment	Soil	Surface Water
Metals			
Arsenic	1		
Barium	4	4	
Cadmium	1	1	
Chromium, total	1		
Lead	1	1	1
Mercury	2		2
Selenium	4	4	
Silver	2		2
Pesticides/PCBs			
4,4' -DDD	2	2	
4,4' -DDE	2	2	
4,4' -DDT	2	2	2
Aldrin		2	
Aroclor 1016	2	2	2
Aroclor 1221			2
Aroclor 1232			2
Aroclor 1242		3	2
Aroclor 1248	2	2	2
Aroclor 1254	2	1	2
Aroclor 1260	2	1	2
Dieldrin	2	2	2
Endosulfan I	2	2	2
Endosulfan II	2	2	2
Endrin	2	2	2
Heptachlor	2	2	2
Heptachlor Epoxide	2	2	2
Methoxychlor	2	2	2
Toxaphene	2	2	2
alpha-Chlordane	2	2	2
gamma BHC (Lindane)	2	2	2
gamma-Chlordane	2	2	2
alpha BHC	2	2	
beta BHC	2	2	
delta BHC	2	2	
Semi-volatile Organics			
1,2-Dichlorobenzene	2		
1,3-Dichlorobenzene	2		
1,4-Dichlorobenzene	2		
2-Methylnaphthalene	2	2	
Acenaphthene	2	2	
Anthracene	2	2	
Benzo(a)anthracene	2	2	
Benzo(a)pyrene	2		
Benzo(b)fluoranthene	2	2	
Benzo(g,h,i)perylene	2	2	
Benzo(k)fluoranthene	2	2	
Butylbenzylphthalate			2

TABLE 3-45. CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN (COPEC) BY MEDIA AT TIN CITY LRRS, ALASKA (Page 2 of 2)

Chemical	Media Sediment	Soil	Surface Water
Chrysene	2	2	
di-n-butyl Phthalate			2
di-n-Octylphthalate			2
Dibenzo(a,h)anthracene	2	2	
Diethyl Phthalate			1
Dimethyl Phthalate			2
Fluorene	2	2	
Hexachlorobenzene	2		2
Hexchlorobutadiene	2	2	2
Hexachlorocyclopentadiene	2	2	2
Indeno(1,2,3-c,d)pyrene	2	2	
N-Nitrosodiphenylamine		3	
Pentachlorophenol	2	2	2
Phenanthrene	2	2	2
Pyrene	1	2	
Volatile Organics			
1,1-Dichloroethene	2	2	
1,3,5-Trimethylbenzene		3	
Ethylbenzene	3	3	
Toluene		3	
xylene, m,p	3	3	3
xylene-o	3	3	3

Key:
1 = Detected concentration exceeded screening value
2 = Practical Quantitation Limit (PQL) exceeded screening value
3 = No screening value available; chemical was detected
4 = No screening value available; metal detected > 3X mean background concentration

Table 3-46. Exposure Point Concentrations (EPC) for Reasonable Maximum Exposure (RME)
Scenario for Chemicals of Potential Ecological Concern
Ecological Baseline Risk Assessment (Page 1 of 4)

Media	Chemical	RME (Beach)	Conc. Type	RME (Lower Camp, Tramway, and Top Camp)	Conc. Type	RME (Airstrip)	Conc. Type	RME (Background)	Conc. Type
Sediment	Arsenic	7.50000	M						
Sediment	Barium	40.80000	M						
Sediment	Cadmium	1.80000	M						
Sediment	Chromium, total	27.40000	M						
Sediment	Lead	118.00000	M						
Sediment	Mercury	0.08000	P						
Sediment	Selenium	1.60000	M						
Sediment	Silver	0.45500	P						
Sediment	4,4' -DDD	0.01200	P			0.01200	P		
Sediment	4,4' -DDE	0.01200	P			0.01200	P		
Sediment	4,4' -DDT	0.01200	P			0.01200	P		
Sediment	Aroclor 1016	0.12000	P			0.12000	P		
Sediment	Aroclor 1248	0.12000	P			0.12000	P		
Sediment	Aroclor 1254	0.12000	P			0.12000	P		
Sediment	Aroclor 1260	0.12000	P			0.12000	P		
Sediment	Dieldrin	0.01200	P			0.01200	P		
Sediment	Endosulfan I	0.00600	P			0.00600	P		
Sediment	Endosulfan II	0.01200	P			0.01200	P		
Sediment	Endrin	0.01200	P			0.01200	P		
Sediment	Heptachlor	0.00600	P			0.00600	P		
Sediment	Heptachlor Epoxide	0.00600	P			0.00600	P		
Sediment	Methoxychlor	0.06000	P			0.06000	P		
Sediment	Toxaphene	0.60000	P			0.60000	P		
Sediment	alpha-Chlordane	0.12000	P			0.12000	P		
Sediment	gamma BHC (Lindane)	0.00600	P			0.00600	P		
Sediment	gamma-Chlordane	0.12000	P			0.12000	P		
Sediment	alpha BHC	0.00600	P			0.00600	P		
Sediment	beta BHC	0.00600	P			0.00600	P		
Sediment	delta BHC	0.00600	P			0.00600	P		
Sediment	1,2-Dichlorobenzene	0.24500	P			0.24500	P		
Sediment	1,3-Dichlorobenzene	0.24500	P			0.24500	P		
Sediment	1,4-Dichlorobenzene	0.24500	P			0.24500	P		
Sediment	2-Methylnaphthalene	0.24500	P			0.24500	P		
Sediment	Acenaphthene	0.24500	P			0.24500	P		
Sediment	Anthracene	0.24500	P			0.24500	P		
Sediment	Benzo(a)anthracene	0.24500	P			0.24500	P		
Sediment	Benzo(a)pyrene	0.24500	P			0.24500	P		
Sediment	Benzo(b)fluoranthene	0.24500	P			0.24500	P		
Sediment	Benzo(g,h,i)perylene	0.24500	P			0.24500	P		
Sediment	Benzo(k)fluoranthene	0.24500	P			0.24500	P		
Sediment	Chrysene	0.24500	P			0.24500	P		
Sediment	Dibenzo(a,h)anthracene	0.24500	P			0.24500	P		

Table 3-46. Exposure Point Concentrations (EPC) for Reasonable Maximum Exposure (RME)
Scenario for Chemicals of Potential Ecological Concern
Ecological Baseline Risk Assessment (Page 2 of 4)

Media	Chemical	RME (Beach)	Conc. Type	RME (Lower Camp)	Conc. Type	RME (Airstrip)	Conc. Type	RME (Background)	Conc. Type
Sediment	Fluorene	0.24500	P			0.24500	P		
Sediment	Hexachlorobenzene	0.24500	P			0.24500	P		
Sediment	Hexchlorobutadiene	0.24500	P			0.24500	P		
Sediment	Hexachlorocyclopentadiene	0.24500	P			0.24500	P		
Sediment	Indeno(1,2,3-c,d)pyrene	0.24500	P			0.24500	P		
Sediment	Pentachlorophenol	1.20000	P			1.20000	P		
Sediment	Phenanthrene	0.24500	P			0.24500	P		
Sediment	Pyrene	0.82000	M			0.24500	P		
Sediment	1,1-Dichloroethene	0.00350	P						
Sediment	Ethylbenzene		P			0.09800	M		
Sediment	xylene		P			0.14900	M		
Soil	Barium			47.50000	M			14.60000	M
Soil	Cadmium			0.80000	M			0.34000	M
Soil	Lead	5.10000	M	357.00000	M			4.70000	M
Soil	Selenium			0.67000	M			0.10500	P
Soil	4,4' -DDD			0.03500	P			0.03500	P
Soil	4,4' -DDE			0.03500	P			0.03500	P
Soil	4,4' -DDT			0.03500	P			0.03500	P
Soil	Aldrin			0.01800	P			0.01800	P
Soil	Aroclor 1016			0.35000	P			0.35000	P
Soil	Aroclor 1242			3.20000	M			0.35000	P
Soil	Aroclor 1248			0.35000	P			0.35000	P
Soil	Aroclor 1254			1.30000	M			0.31000	M
Soil	Aroclor 1260			0.79000	M			0.35000	P
Soil	Dieldrin			0.03500	P			0.03500	P
Soil	Endosulfan I			0.01800	P			0.01800	P
Soil	Endosulfan II			0.03500	P			0.03500	P
Soil	Endrin			0.03500	P			0.03500	P
Soil	Heptachlor			0.01800	P			0.01800	P
Soil	Heptachlor Epoxide			0.01800	P			0.01800	P
Soil	Methoxychlor			0.18000	P			0.18000	P
Soil	Toxaphene			1.80000	P			1.80000	P
Soil	alpha-Chlordane			0.35000	P			0.35000	P
Soil	gamma BHC (Lindane)			0.01800	P			0.01800	P
Soil	gamma-Chlordane			0.35000	P			0.35000	P
Soil	alpha BHC			0.01800	P			0.01800	P
Soil	beta BHC			0.01800	P			0.01800	P
Soil	delta BHC			0.01800	P			0.01800	P
Soil	2-Methylnaphthalene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Acenaphthene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Anthracene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Benzo(a)anthracene	0.18500	P	0.18500	P	0.18500	P	0.18500	P

Table 3-46. Exposure Point Concentrations (EPC) for Reasonable Maximum Exposure (RME)
Scenario for Chemicals of Potential Ecological Concern
Ecological Baseline Risk Assessment (Page 3 of 4)

Media	Chemical	RME (Beach)	Conc. Type	RME (Lower Camp)	Conc. Type	RME (Airstrip)	Conc. Type	RME (Background)	Conc. Type
Soil	Benzo(b)fluoranthene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Benzo(g,h,i)perylene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Benzo(k)fluoranthene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Chrysene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Dibenzo(a,h)anthracene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Fluorene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Hexchlorobutadiene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Hexachlorocyclopentadiene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Indeno(1,2,3-c,d)pyrene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	N-Nitrosodiphenylamine	0.96000	M	0.00000	P	0.00000	P	0.00000	P
Soil	Pentachlorophenol	0.90000	P	0.90000	P	0.90000	P	0.90000	P
Soil	Phenanthrene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	Pyrene	0.18500	P	0.18500	P	0.18500	P	0.18500	P
Soil	1,1-Dichloroethene			0.00250	P				
Soil	1,3,5-Trimethylbenzene			0.30000	M				
Soil	Ethylbenzene	0.01400	M	0.01600	M	0.08500	M	0.01200	M
Soil	Toluene	0.00250	P	0.00250	P	0.00100	M	0.00250	P
Soil	xylene	0.03700	M	0.01400	M	0.56000	M	0.01900	M
Surface Water	Barium	8.50000	P					150.00000	M
Surface Water	Lead	468.00000	M					9.40000	M
Surface Water	Mercury	0.05000	P					0.05000	P
Surface Water	Silver	1.50000	P					1.50000	P
Surface Water	4,4' -DDT	0.25000	P			0.25000	P	0.25000	P
Surface Water	Aroclor 1016	2.50000	P			2.50000	P	2.50000	P
Surface Water	Aroclor 1221	5.00000	P			5.00000	P	5.00000	P
Surface Water	Aroclor 1232	2.50000	P			2.50000	P	2.50000	P
Surface Water	Aroclor 1242	2.50000	P			2.50000	P	2.50000	P
Surface Water	Aroclor 1248	2.50000	P			2.50000	P	2.50000	P
Surface Water	Aroclor 1254	2.50000	P			2.50000	P	2.50000	P
Surface Water	Aroclor 1260	2.50000	P			2.50000	P	2.50000	P
Surface Water	Dieldrin	0.25000	P			0.25000	P	0.25000	P
Surface Water	Endosulfan I	0.12500	P			0.12500	P	0.12500	P
Surface Water	Endosulfan II	0.25000	P			0.25000	P	0.25000	P
Surface Water	Endrin	0.25000	P			0.25000	P	0.25000	P
Surface Water	Heptachlor	0.12500	P			0.12500	P	0.12500	P
Surface Water	Heptachlor Epoxide	0.12500	P			0.12500	P	0.12500	P
Surface Water	Methoxychlor	1.25000	P			1.25000	P	1.25000	P
Surface Water	Toxaphene	12.50000	P			12.50000	P	12.50000	P
Surface Water	alpha-Chlordane	2.50000	P			2.50000	P	2.50000	P
Surface Water	gamma BHC (Lindane)	0.12500	P			0.12500	P	0.12500	P
Surface Water	gamma-Chlordane	2.50000	P			2.50000	P	2.50000	P
Surface Water	Butylbenzylphthalate	5.00000	P			5.00000	P	5.00000	P

Table 3-46. Exposure Point Concentrations (EPC) for Reasonable Maximum Exposure (RME) Scenario for Chemicals of Potential Ecological Concern Ecological Baseline Risk Assessment (Page 4 of 4)

Media	Chemical	RME (Beach)	Conc. Type	RME (Lower Camp)	Conc. Type	RME (Airstrip)	Conc. Type	RME (Background)	Conc. Type
Surface Water	di-n-butyl Phthalate	5.00000	P			5.00000	P	5.00000	P
Surface Water	di-n-Octylphthalate	5.00000	P			5.00000	P	5.00000	P
Surface Water	Diethyl Phthalate	5.00000	P			20.00000	M	5.00000	P
Surface Water	Dimethyl Phthalate	5.00000	P			5.00000	P	5.00000	P
Surface Water	Hexachlorobenzene	5.00000	P			5.00000	P	5.00000	P
Surface Water	Hexchlorobutadiene	5.00000	P			5.00000	P	5.00000	P
Surface Water	Hexachlorocyclopentadiene	5.00000	P			5.00000	P	5.00000	P
Surface Water	Pentachlorophenol	25.00000	P			25.00000	P	25.00000	P
Surface Water	Phenanthrene	5.00000	P			5.00000	P	5.00000	P
Surface Water	xylene	3.40000	M			5.90000	M	0.00000	P

All soil and sediment data in mg/kg. Surface water data in ug/L.

Concentration Types:

P = One-half the PQL for Undetected Chemicals Which Exceeded Risk-based Screening Concentrations

N = 95% UCL

M = Maximum Concentration Reported

Table 3-47. Extrapolated Oral Reference Doses of COPECs for Arctic Fox, Ground Squirrel, Steller's Eider Semipalmated Plover and Kittlitz's Murrelet (Page 1 of 2)

COPEC	Study Type	Study Duration	Tox. Oral Endpoint	Species	Original dose (mg/kg·d)	Ref (oral)	Arctic Fox		Ground Squirrel		Steller's Eider, Kittlitz's Murrelet, Semipalmated Plover	
							Uncertainty Factor	Extrapolated Dose (mg/kg·d)	Uncertainty Factor	Extrapolated Dose (mg/kg·d)	Uncertainty Factor	Extrapolated Dose (mg/kg·d)
Metals												
Arsenic	NOAEL	chronic	systemic	rat	1.4	ATSDR	100	0.014	60	0.0233	1000	0.0014
Barium	TDLo	chronic	vascular	rat	26622	RTECS	1000	26.622	600	44.3700	10000	2.6622
Cadmium	TDLo	chronic	fertility	rat	21.5	RTECS	1000	0.0215	600	0.0358	10000	0.00215
Chromium	NOAEL	chronic	systemic	rat	0.46	ATSDR	100	0.0046	60	0.0077	1000	0.00046
Lead	TDLo	chronic	fertility	mouse	300	RTECS	1000	0.3	600	0.5000	10000	0.03
Mercury	TDLo	chronic	behavior	man	43	RTECS	1000	0.043	1000	0.0430	10000	0.0043
Selenium	TDLo	chronic	embryo	mouse	134	RTECS	1000	0.134	600	0.2233	10000	0.0134
Silver	LD50	acute	unknown	guinea pig	5000	RTECS	500000	0.01	300000	0.0167	5000000	0.001
Pesticides/PCBs												
4,4'-DDD	NOAEL	chronic	systemic	rat	165	ATSDR	100	1.65	60	2.7500	1000	0.165
4,4'-DDE	NOAEL	chronic	systemic	rat	42	ATSDR	100	0.42	60	0.7000	1000	0.042
4,4'-DDT	NOAEL	chronic	systemic	rat	32	ATSDR	100	0.32	60	0.5333	1000	0.032
Aldrin	NOAEL	chronic	systemic	rat	0.5	ATSDR	100	0.005	60	0.0083	1000	0.0005
Aroclor 1016	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Aroclor 1221	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Aroclor 1232	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Aroclor 1242	TDLo	chronic	liver	rat	366	RTECS	1000	0.366	600	0.6100	10000	0.0366
Aroclor 1248	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Aroclor 1254	NOAEL	chronic	fertility	rat	1	ATSDR	100	0.01	60	0.0167	1000	0.001
Aroclor 1260	NOAEL	chronic	fertility	rat	5	ATSDR	100	0.05	60	0.0833	1000	0.005
Dieldrin	NOAEL	chronic	liver	rat	3	HEAST	100	0.03	60	0.0500	1000	0.003
Endosulfan I	LD50	acute	unknown	rat	76	RTECS	500000	0.000152	300000	0.0003	5000000	0.0000152
Endosulfan II	LD50	acute	unknown	rat	240	RTECS	500000	0.00048	300000	0.0008	5000000	0.000048
Endrin	NOEL	chronic	unknown	dog	0.025	HEAST	1	0.025	100	0.0003	1000	0.000025
Heptachlor	NOEL	chronic	liver	rat	0.15	HEAST	100	0.0015	60	0.0025	1000	0.00015
Heptachlor Epoxide	LOAEL	chronic	liver	dog	0.0125	HEAST	10	0.00125	1000	0.0000	10000	0.00000125
Methoxychlor	NOEL	chronic	maternal	rabbit	5.01	HEAST	100	0.0501	100	0.0501	1000	0.00501
Toxaphene	TDLo	chronic	embryo	mouse	100	RTECS	1000	0.1	600	0.1667	10000	0.01
alpha-Chlordane	LD50	acute	unknown	mouse	125	RTECS	500000	0.00025	300000	0.0004	5000000	0.000025
gamma BHC (Lindane)	TDLo	chronic	tumor	mouse	14000	RTECS	1000	14	600	23.3333	10000	1.4
gamma-Chlordane	TDLo	chronic	liver	mouse	112	RTECS	1000	0.112	600	0.1867	10000	0.0112
alpha BHC	LD50	acute	unknown	mouse	59	RTECS	500000	0.000118	300000	0.0002	5000000	0.0000118
beta BHC	TDLo	chronic	nervous sys	rat	1989	RTECS	1000	1.989	600	3.3150	10000	0.1989
delta BHC	LD50	acute	unknown	mouse	59	RTECS	500000	0.000118	300000	0.0002	5000000	0.0000118
Semi-volatile Organics												
1,2-Dichlorobenzene	TDLo	chronic	kidney	rat	27.3	RTECS	1000	0.0273	600	0.0455	10000	0.00273
1,3-Dichlorobenzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1,4-Dichlorobenzene	NOAEL	chronic	systemic	rat	600	ATSDR	100	6	60	10.0000	1000	0.6
2-Methylnaphthalene	LD50	acute	unknown	rat	1630	RTECS	500000	0.00326	300000	0.0054	5000000	0.000326
Acenaphthylene	LD50	acute	unknown	rat	1700	RTECS	500000	0.0034	300000	0.0057	5000000	0.00034
Anthracene	NOAEL	chronic	liver	mouse	1000	HEAST	100	10	60	16.6667	1000	1
Benzo(a)anthracene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Benzo(a)pyrene	TDLo	chronic	systemic	hamster	420	RTECS	1000	0.42	600	0.7000	10000	0.042
Benzo(b)fluoranthene	TDLo	chronic	gastro	mice	191.8	Superfund	1000	0.1918	1000	0.1918	10000	0.01918
Benzo(g,h,i)perylene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Benzo(k)fluoranthene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Butylbenzylphthalate	NOAEL	chronic	liver	rat	159	HEAST	100	1.59	60	2.6500	1000	0.159
Chrysene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 3-47. Extrapolated Oral Reference Doses of COPECs for Arctic Fox, Ground Squirrel, Steller's Eider Semipalmated Plover and Kittlitz's Murrelet (Page 2 of 2)

							Arctic Fox		Ground Squirrel		Steller's Eider, Kittlitz's Murrlelet, Semipalmated Plover	
COPEC	Study Type	Study Duration	Tox. Oral Endpoint	Species	Original dose (mg/kg·d)	Ref (oral)	Uncertainty Factor	Extrapolated Dose (mg/kg·d)	Uncertainty Factor	Extrapolated Dose (mg/kg·d)	Uncertainty Factor	Extrapolated Dose (mg/kg·d)
di-n-butyl Phthalate	NOAEL	chronic	embryo	rat	125	HEAST	100	1.25	60	2.0833	1000	0.125
di-n-octylphthalate	TDLo	chronic	liver	rat	23000	RTECS	1000	23	600	38.3333	10000	2.3
Dibenzo(a,h)anthracene	TDLo	chronic	tumor	mouse	4160	RTECS	1000	4.16	600	6.9333	10000	0.416
Diethyl Phthalate	NOAEL	chronic	unknown	rat	750	HEAST	100	7.5	60	12.5000	1000	0.75
Dimethylphthalate	NOEL	chronic	unknown	rat	1000	HEAST	100	10	60	16.6667	1000	1
Fluorene	NOAEL	chronic	unknown	mouse	125	HEAST	100	1.25	60	2.0833	1000	0.125
Hexachlorobenzene	NOAEL	chronic	hepatic	rat	0.08	ATSDR	100	0.0008	60	0.0013	1000	0.00008
Hexachlorobutadiene	TDLo	chronic	newborn	rat	45	RTECS	1000	0.045	600	0.0750	10000	0.0045
Hexachlorocyclopentadiene	LDLo	chronic	unknown	rabbit	420	RTECS	1000	0.42	1000	0.4200	10000	0.042
Indeno(1,2,3-c,d)pyrene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
N-nitrosodiphenylamine	TDLo	chronic	tumor	rat	140000	RTECS	1000	140	600	233.3333	10000	14
Pentachlorophenol	NOAEL	chronic	systemic	rat	10	ATSDR	100	0.1	60	0.1667	1000	0.01
Phenanthrene	LDLo	chronic	vascular	rabbit	70	RTECS	1000	0.07	1000	0.0700	10000	0.007
Pyrene	LDLo	chronic	behavioral	mouse	800	RTECS	1000	0.8	600	1.3333	10000	0.08
Volatile organics												
1,1-Dichloroethene	TDLo	chronic	fertility	rat	200	RTECS	1000	0.2	600	0.3333	10000	0.02
1,3,5-Trimethylbenzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ethylbenzene	LD50	acute	liver	rat	3500	RTECS	500000	0.007	300000	0.0117	5000000	0.0007
Toluene	NOAEL	chronic	liver	rat	223	HEAST	100	2.23	60	3.7167	1000	0.223
Xylenes, total	TDLo	chronic	embryo	mouse	20.6	RTECS	1000	0.0206	600	0.0343	10000	0.00206

NOAEL or NOEL = Dose at which no adverse effects are observed
LOAEL or TDLo = lowest dose at which adverse effects are observed
LD50 = dose which is lethal to 50 percent of the test population
LDLo = lowest dose to cause death in animals

Table 3-48. Body Weights and Ingestion Rates used in Risk Estimate Calculations

Receptor	Body Weight (g)	Plant Ingestion (g/day)	Soil Ingestion (g/day)	Sediment Ingestion (g/day)	Water Ingestion (L/day)
Arctic Fox	4536	-	23.8	-	0.5561
Arctic Ground Squirrel	500	20.67	2.07	-	0.0531
Kittlitz's Murrelet	236	-	-	2.32	0.0224
Semipalmated Plover	50	-	-	0.78	0.0079
Steller's Eider	907	7.77	5.98	-	0.0553

Table 3-49. ESTIMATED RISK TO ARCTIC GROUND SQUIRREL FROM DIETARY EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Beach	Lower Camp, Tram-way, Top Camp	Airstrip	Background
Aroclor 1242	n/a	0.00E+00	n/a	ns
Aroclor 1254	n/a	0.00E+00	n/a	0.00E+00
Aroclor 1260	n/a	0.00E+00	n/a	ns
N-Nitrosodiphenylamine	4.32E-06	ns	ns	ns
1,3,5-Trimethylbenzene	n/a	n/tox	n/a	n/a
Ethylbenzene	1.22E-03	1.40E-03	7.43E-03	1.05E-03
Toluene	ns	ns	6.26E-07	ns
Xylenes, total	1.02E-03	3.87E-04	1.55E-02	5.26E-04
Total for Detected COPECs	2.25E-03	1.79E-03	2.29E-02	1.57E-03
Total for Non-detected COPECs	1.53E-02	1.48E-01	1.53E-02	1.48E-01

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-50. ESTIMATED RISK TO STELLER'S EIDER FROM DIETARY EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Beach	Lower Camp, Tram-way, Top Camp	Airstrip	Background
Aroclor 1242	n/a	0.00E+00	n/a	ns
Aroclor 1254	n/a	0.00E+00	n/a	0.00E+00
Aroclor 1260	n/a	0.00E+00	n/a	ns
N-Nitrosodiphenylamine	1.87E-05	ns	ns	ns
1,3,5-Trimethylbenzene	n/a	n/tox	n/a	n/a
Ethylbenzene	5.31E-03	6.07E-03	3.22E-02	4.55E-03
Toluene	ns	ns	2.72E-06	ns
Xylenes, total	4.42E-03	1.68E-03	6.72E-02	2.28E-03
Total for Detected COPECs	9.75E-03	7.75E-03	9.95E-02	6.83E-03
Total for Non-detected COPECs	6.62E-02	6.04E-01	6.62E-02	6.04E-01

n/a = no analysis performed for this compound
ns = not significant; chemical was not a COPEC at this site
n/tox = no toxicological data located

Table 3-51. ESTIMATED RISK TO THE ARCTIC FOX FROM WATER INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Hazard Quotient			
	Beach	Lower Camp, Tram-way and Top Camp	Airstrip	Background
Lead	9.54E-02	n/a	n/a	1.92E-03
Diethyl Phthalate	ns	n/a	1.63E-04	ns
Xylenes, total	1.01E-02	n/a	1.75E-02	ns
Total for Detected COPECs	1.05E-01	n/a	1.77E-02	1.92E-03
Total for Non-detected COPECs	1.15E+00	n/a	1.14E+00	1.15E+00

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-52. ESTIMATED RISK TO THE ARCTIC GROUND SQUIRREL FROM WATER INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Hazard Quotient			
	Beach	Lower Camp, Tram-way and Top Camp	Airstrip	Background
Lead	3.95E-02	n/a	n/a	7.93E-04
Diethyl Phthalate	ns	n/a	6.75E-05	ns
Xylenes, total	4.18E-03	n/a	7.25E-03	ns
Total for Detected COPECs	4.37E-02	n/a	7.32E-03	7.93E-04
Total for Non-detected COPECs	9.41E-01	n/a	9.37E-01	9.41E-01

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-53. ESTIMATED RISK TO SEMIPALMATED PLOVER FROM WATER INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA				
	Hazard Quotient			
Detected COPECs	Beach	Lower Camp, Tram-way and Top Camp	Airstrip	Background
Lead	1.23E+00	n/a	n/a	2.48E-02
Diethyl Phthalate	ns	n/a	2.11E-03	ns
Xylenes, total	1.30E-01	n/a	2.26E-01	ns
Total for Detected COPECs	1.36E+00	n/a	2.29E-01	2.48E-02
Total for Non-detected COPECs	2.35E+01	n/a	2.34E+01	2.35E+01

n/a = no analysis performed for this compound
ns = not significant; chemical was not a COPEC at this site
n/tox = no toxicological data located

Table 3-54. ESTIMATED RISK TO KITTLITZ'S MURRELET FROM WATER INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA				
	Hazard Quotient			
Detected COPECs	Beach	Lower Camp, Tram-way and Top Camp	Airstrip	Background
Lead	7.39E-01	n/a	n/a	1.48E-02
Diethyl Phthalate	ns	n/a	1.26E-03	ns
Xylenes, total	7.82E-02	n/a	1.36E-01	ns
Total for Detected COPECs	8.17E-01	n/a	1.37E-01	1.48E-02
Total for Non-detected COPECs	1.41E+01	n/a	1.40E+01	1.41E+01

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-55. ESTIMATED RISK TO STELLER'S EIDER FROM WATER INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Hazard Quotient Beach	Lower Camp, Tram-way and Top Camp	Airstrip	Background
Lead	4.74E-01	n/a	n/a	9.52E-03
Diethyl Phthalate	ns	n/a	8.10E-04	ns
Xylenes, total	5.01E-02	n/a	8.70E-02	ns
Total for Detected COPECs	5.24E-01	n/a	8.78E-02	9.52E-03
Total for Non-detected COPECs	9.04E+00	n/a	9.00E+00	9.04E+00

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-56. ESTIMATED RISK TO ARCTIC FOX FROM SOIL INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Beach	Lower Camp, Tram-way, Top Camp	Airstrip	Background
Barium	n/a	4.67E-03	n/a	1.44E-03
Cadmium	n/a	9.74E-02	n/a	4.14E-02
Lead	4.45E-02	3.12E+00	n/a	4.10E-02
Selenium	n/a	1.31E-02	n/a	ns
Aroclor 1242	n/a	2.29E-02	n/a	ns
Aroclor 1254	n/a	3.40E-01	n/a	8.12E-02
Aroclor 1260	n/a	4.14E-02	n/a	ns
N-Nitrosodiphenylamine	1.80E-05	ns	ns	ns
1,3,5-Trimethylbenzene	n/a		n/a	n/a
Ethylbenzene	5.24E-03	5.98E-03	3.18E-02	4.49E-03
Toluene	ns	ns	1.53E-06	ns
Xylenes, total	4.68E-03	1.78E-03	7.12E-02	2.41E-03
Total for Detected COPECs	0.05	3.64	0.10	0.17
Total for Non-detected COPECs	0.34	5.47	0.34	5.45

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-57. ESTIMATED RISK TO ARCTIC GROUND SQUIRREL FROM SOIL INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Beach	Lower Camp, Tram-way, Top Camp	Airstrip	Background
Barium	n/a	1.76E-03	n/a	5.40E-04
Cadmium	n/a	3.67E-02	n/a	1.56E-02
Lead	1.68E-02	1.17E+00	n/a	1.54E-02
Selenium	n/a	4.93E-03	n/a	ns
Aroclor 1242	n/a	8.62E-03	n/a	ns
Aroclor 1254	n/a	1.28E-01	n/a	3.05E-02
Aroclor 1260	n/a	1.56E-02	n/a	ns
N-Nitrosodiphenylamine	6.76E-06	ns	ns	ns
1,3,5-Trimethylbenzene	n/a		n/a	n/a
Ethylbenzene	1.97E-03	2.25E-03	1.20E-02	1.69E-03
Toluene	ns	ns	5.74E-07	ns
Xylenes, total	1.76E-03	6.70E-04	2.68E-02	9.09E-04
Total for Detected COPECs	0.02	1.37	0.04	0.06
Total for Non-detected COPECs	0.13	4.64	0.13	4.64

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-58. ESTIMATED RISK TO SEMIPALMATED PLOVER FROM SEDIMENT INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Hazard Quotient			
	Beach	Lower Camp, Tram-way, Top Camp	Airstrip	Background
Arsenic	4.15E+01	n/a	n/a	n/a
Barium	1.19E-01	n/a	n/a	n/a
Cadmium	6.49E+00	n/a	n/a	n/a
Chromium, total	4.62E+02	n/a	n/a	n/a
Lead	3.05E+01	n/a	n/a	n/a
Selenium	9.26E-01	n/a	n/a	n/a
Pyrene	7.95E-02	n/a	n/a	n/a
Ethylbenzene	n/a	n/a	1.09E+00	n/a
Xylenes, total	n/a	n/a	5.61E-01	n/a
Total for Detected COPECs	541.48	n/a	1.65	n/a
Total for Non-detected COPECs	134.09	n/a	134.09	n/a

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-59. ESTIMATED RISK TO STELLER'S EIDER FROM SOIL INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA

Detected COPECs	Beach	Lower Camp, Tram-way, Top Camp	Airstrip	Background
Barium	n/a	5.87E-02	n/a	1.80E-02
Cadmium	n/a	1.22E+00	n/a	5.20E-01
Lead	5.59E-01	3.91E+01	n/a	5.15E-01
Selenium	n/a	1.64E-01	n/a	ns
Aroclor 1242	n/a	2.87E-01	n/a	ns
Aroclor 1254	n/a	4.27E+00	n/a	1.02E+00
Aroclor 1260	n/a	5.20E-01	n/a	ns
N-Nitrosodiphenylamine	2.25E-04	ns	ns	ns
1,3,5-Trimethylbenzene	n/a		n/a	n/a
Ethylbenzene	6.58E-02	7.52E-02	3.99E-01	5.64E-02
Toluene	ns	ns	1.92E-05	ns
Xylenes, total	5.87E-02	2.23E-02	8.94E-01	3.03E-02
Total for Detected COPECs	0.68	45.75	1.29	2.16
Total for Non-detected COPECs	0.94	60.50	0.94	60.73

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-60. ESTIMATED RISK TO KITTLITZ'S MURRELET FROM SEDIMENT INTAKE EXPOSURE ROUTE AT TIN CITY LRRS, ALASKA				
	Hazard Quotient			
Detected COPECs	Beach	Lower Camp, Tram-way, Top Camp	Airstrip	Background
Arsenic	2.62E+01	n/a	n/a	n/a
Barium	7.51E-02	n/a	n/a	n/a
Cadmium	4.10E+00	n/a	n/a	n/a
Chromium, total	2.92E+02	n/a	n/a	n/a
Lead	1.93E+01	n/a	n/a	n/a
Selenium	5.85E-01	n/a	n/a	n/a
Pyrene	5.02E-02	n/a	n/a	n/a
Ethylbenzene	n/a	n/a	6.86E-01	n/a
Xylenes, total	n/a	n/a	3.54E-01	n/a
Total for Detected COPECs	342.05	n/a	1.04	n/a
Total for Non-detected COPECs	84.70	n/a	84.70	n/a

n/a = no analysis performed for this compound

ns = not significant; chemical was not a COPEC at this site

n/tox = no toxicological data located

Table 3-61. Summary of COPECs Which Exceed a 10E-6 Risk Value at Tin City LRRS

Site	Sample Location	Contaminant	Exposure Pathway	Hazard Quotient
DP 011a	Sediment	Arsenic	Sediment intake by Kittlitz's Murrelet	2.62E+00
DP 011a	Sediment	Arsenic	Sediment intake by Semipalmated Plover	4.15E+01
DP 011a	Sediment	Cadmium	Sediment intake by Semipalmated Plover	6.49E+00
DP 011a	Sediment	Cadmium	Sediment intake by Kittlitz's Murrelet	4.10E+00
DP 011a	Sediment	Chromium, total	Sediment intake by Kittlitz's Murrelet	2.92E+02
DP 011a	Sediment	Chromium, total	Sediment intake by Semipalmated Plover	4.62E+02
DP 011a	Sediment	Lead	Sediment intake by Semipalmated Plover	3.05E+01
DP 011a	Sediment	Lead	Sediment intake by Kittlitz's Murrelet	1.93E+01
ST 12c	Sediment	Ethylbenzene	Sediment intake by Semipalmated Plover	1.09E+00
AOC 1	Surface Water	Lead	Water intake by Semipalmated Plover	1.23E+00
AOC 2	Soil Boring 0.0 - 0.5 ft.	Lead	Soil intake by Arctic Fox	3.12E+00
AOC 2	Soil Boring 0.0 - 0.5 ft.	Lead	Soil intake by Artic Ground Squirrel	1.17E+00
AOC 2	Soil Boring 0.0 - 0.5 ft.	Lead	Soil intake by Steller's Eider	3.91E+01
AOC 2	Soil Boring 0.0 - 0.5 ft.	Aroclor 1254	Soil intake by Steller's Eider	4.27E+00
SS 13a	Soil Boring 0.5 - 2.5 ft.	Cadmium	Soil intake by Steller's Eider	1.22E+00

Appendix A

Glossary

CONVERSION FACTORS

SOILS AND SEDIMENTS

1 mg/kg is equal to 1 part per million (ppm)

1 ug/kg is equal to 1 part per billion (ppb)

1,000 ug/kg = 1 mg/kg

WATER

1 mg/l is equivalent to 1 part per million (ppm)

1 ug/l is equivalent to 1 part per billion (ppb)

1,000 ug/l = 1 mg/l

1,000,000 pg/l - 1 ug/l

Appendix B

Scope of Work

Dave Fulton
CC: ANC-1
3380 0020

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS HUMAN SYSTEMS CENTER (AFMC)
BROOKS AIR FORCE BASE, TEXAS

CONTRACTOR COPY

23 AUG 94

MEMORANDUM FOR EA ENGINEERING, SCIENCE AND TECHNOLOGY
11019 McCORMICK ROAD
HUNT VALLEY MD 21031

FROM: HSC/PKVBC
8005 9th STREET
BROOKS AFB TX 78235-5353

MAIL DATE
SEP 0 2 1994

SUBJECT: Letter of Transmittal, Contract F41624-94-D-8052-0010

1. The attached documents are forward for your information and action as required.

a. Document Number F41624-94-D-8052-0010, with attachments.

b. Statement of Work (SOW), dated 13 Aug 94 (Attachment 1 to Document).

c. Government Points of Contact.

Note: Appointment of Contracting Officer's Representative (COR) will be provided at a later date.

2. As indicated in paragraph 7 (Page 4 of 4), this order is issued with the following requirements:
Contractor will submit to the Government an order specific sub-contracting plan, "within 60 days of the date of receipt of this order".

3. Direct any questions to Edwin Custodio at (210) 536-4493 or Fax (210) 536-6003.

Mary Lou Lugo
MARY LOU LUGO
Contracting Officer

)

MAIL DATE

SEP (.. 1994

SUBJECT: Government Points of Contact for Tin City AFS, AK Under Contract F41624-94-D-8052

The following is the list of Government Points of Contact:

Remedial Project Manager: and Point of Contact

Mr. Tim Hansen
11 CEOS/CEVR
21885 Second Street
Elmendorf AFB, AK 99506-4420
Tel (907) 552-4532
Fax (907) 552-1533

Contracting Officer's Representative:

Robert Garland
AFCEE/ERD-AK
21885 Second Street
Elmendorf AFB, AK 99506-4402
Tel (907) 552-4532
Fax (907) 552-1591

On-Site AFCEE Representative:

Robert Garland
AFCEE/ERD-AK
21885 Second Street
Elmendorf AFB, AK 99506-4402
Tel (907) 552-4532
Fax (907) 552-1591

If you have any questions, please contact me at 4-5297.

SAMER N. KARMI, GS-12
Alaska Restoration Team Chief

REF 55X

ORDER FOR SUPPLIES OR SERVICES

1. PAGE 1 OF 4

2. PROC INSTRUMENT ID NO. (PIIN): F41624 94 D 8052
MARK ALL PACKAGES & PAPERS WITH THIS NUMBER

3. CALL/ORDER NO.: 0010

4. DATE OF ORDER*: 94 AUG 25

5. REQUISITION/PURCHASE REQUEST PROJECT NO.: FY7624-94-08723
PROJECT #FSXB94-7948

6. CERTIFIED FOR NATIONAL DEFENSE UNDER BDC REG 2/DMS REG 1 RATING: C-2

7. ISSUED BY CODE FA8900
DEPARTMENT OF THE AIR FORCE
AIR FORCE MATERIEL COMMAND
HSC/PK. 8005 9th Street
BROOKS AFB. TX 78235-5353
BUYER: EDWIN CUSTODIO/PKVBC
PHONE: (210)536-4493

8. ADMINISTERED BY CODE S2101A
DCMAO, BALTIMORE
200 TOWSONTOWN BLVD, WEST
TOWSON MD 21204-5299

DUPLICATE ORIGINAL

9. CONTRACTOR CODE 7V713 FACILITY CODE
NAME AND ADDRESS
EA ENGINEERING, SCIENCE AND TECHNOLOGY
11019 MC CORMICK ROAD
HUNT VALLEY MD 21031

IF "√" FOR MULTIPLE FACILITIES SEE SECT "G"

MAIL DATE
SEP 0 ? 1994

10. MAIL INVOICES TO: U

11. DISCOUNT FOR PROMPT PAYMENT
1 ST ___ % ___ DAYS
2 ND ___ % ___ DAYS
3 RD ___ % ___ DAYS
NET ___ DAYS
OTHER
IF "√" SEE SECT "B"

12A. PURCHASE OFFICE POINT OF CONTACT: MVH/M1E/MVH

12B. RESERVED FOR SERVICE/AGENCY USE

13. PAYMENT WILL BE MADE BY CODE SC1034 IF "√" SEE SECT "G"
DFAS-COLUMBUS CENTER
DFAS-CO CAPITOL DIVISION
P.O. BOX 182263
COLUMBUS OH 43218-2263

14. TYPE CONTRACTOR: C

15. SECURITY A. CLAS: U B. DATE OF DD 254

16. CONTRACT ADMINISTRATION DATA
A. FAST PAY B. CONTRACT (1) KIND: I (2) TYPE: Y C. ABSTRACT RECP ADP POINT D. SPL CONT PROVISIONS E. CONT ADMIN FUND LMT

17. (RESERVED)

18. SVC/AGENCY USE

19. SURVI CRIT: C

20. TOTAL AMOUNT: $529,669.00

21. APPROPRIATION AND ACCOUNTING DATA
A. SCTY CLAS B. ACRN C. APPROPRIATION D. LMT SUBHEAD E. SUPPLEMENTAL ACCOUNTING CLASSIFICATION
SEE SECTION "G" (PAGE 4 OF 4)
F. CPN RECIPIENT CODAAD G. OBLIGATION AMOUNT H. NON-CLIN / ELIN PAYMENT PROV I. SVC AGENCY USE

22A. TYPE OF ORDER
DELIVERY X
B. NON-DOD CONTRACT NO.
This delivery order is subject to instructions contained on this side of form only and is issued in accordance with and subject to terms and conditions of above numbered contract, or Non-DOD Contract No.

PURCHASE
Reference your
Furnish the following on terms specified herein, including, for U.S. purchases, General Provisions of Purchase Order on DD Form 1155 - (EXCEPT CLAUSE NO 16 APPLIES ONLY IF THIS BOX IS CHECKED, AND NO 18 IF THIS BOX IS CHECKED). special provisions ___ and delivery as indicated. This purchase is negotiated under authority of 10 USC 2304(a)( ) or as specified in the schedule if within the U.S., its possessions or Puerto Rico; if otherwise, under 2304(a)(6).
If checked Additional General Provisions apply, supplier shall sign 'Acceptance' on DD Form 1155 and return copies.

* If quantity accepted by the Government is same as quantity ordered, indicated by √ mark. If different enter actual quantity accepted below quantity ordered and encircle.

23. UNITED STATES OF AMERICA
Mary Lou Lugo
MARY LOU LUGO
BY: NAME OF CONTRACTING/ORDERING OFFICER AND DATE
94AUG25
(YYMMMDD)

24. TOTAL

25. DIFFERENCES

25. QUANTITY ORDERED HAS BEEN
INSPECTED RECEIVED ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS STATED

DATE SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

26. SHIP NO.
PARTIAL
FINAL

27. D.O. VOUCHER NO.

28. INITIALS

30. PAYMENT
COMPLETE
PARTIAL
FINAL

31. PAID BY

32. Amount Verified Correct For

33. CHECK NUMBER

34. BILL OF LADING NO.

35. I CERTIFY THIS AMOUNT IS CORRECT AND PROPER FOR PAYMENT

SIGNATURE AND TITLE OF CERTIFYING OFFICER

36. RECEIVED AT

37. RECEIVED BY

38. DATE RECEIVED

39. TOTAL CONTAINERS

40. S/R ACCOUNT NUMBER

41. S/R VOUCHER NO.

*When used as a formal contract this will be the effective date.

PREVIOUS EDITION IS OBSOLETE

AFMC Form 700, JUL 92
REPLACES AFSC FORM 700, AUG 80 WHICH IS OBSOLETE

CEILING TOTAL AMOUNT IS $529,669.00

1. In accordance with the provisions and the authority of "Ordering Procedures" Clause (H-009) of the Basic Contract F41624-94-D-8052 and Delivery Order 0010, the contractor shall accomplish the effort described in the Statement of Work (SOW) dated 13 Aug 94 as Attachment #1, hereto at a total ceiling price of $529,669.00.

2. SECTION B Supplies/Services:

Item No	Supplies/Services		Quantity Purch Unit	Unit Price Total Item Amt
0001AF	SubCLIN	sec class: U	1 LO	$473,193.00

noun: INVESTIGATION, ASSESSMENT SURVEY and ANALYSIS
acm: AA nsn: N
site codes pqa: D acp: D fob: D
pr/mipr data: FY7624-94-08723

-

descriptive data:
Conduct work in accordance with the Statement of Work (SOW) of this order, dated 13 Aug 94 and section C, the Description/Specifications of the basic contract. Submit data in accordance with 5.0 (Data Management) as implemented by this order's SOW.

Item No	Supplies/Services		Quantity Purch Unit	Unit Price Total Item Amt
0004AA	SubCLIN	sec class: U	1 LO	$56,476.00

noun: SUPPORT
acm: AA nsn: N
site codes pqa: D acp: D fob: D
pr/mipr data: FY7624-94-08723

descriptive data:
The contractor shall provide support consisting of materials, communications, subcontracting and travel in accordance with the SOW, dated 13 Aug 94, of this order and section C, the Description/Specification, of the basic contract.

0005AF	CLIN	sec class: U	1 LO	NSP

noun: DATA
acrn: AA   nsn: N
site codes pqa: D acp: D fob: D
pr/mipr data: FY7624-94-08723

descriptive data:
The contractor shall provide data in accordance with Section 5.0, as implemented by directions provided in the SOW dated 13 Aug 94.

3. SECTION C Description/Specification: See attached SOW entitled "Remedial Investigation/Feasibility Study, Tin City Air Force Station , Alaska" , dated 13 Aug 94.

4. SECTION F Schedule data:

Item	Supplies Schedule Data		Delivery Quantity	Schedule Date
0001AF	CLIN DEL SCH	sec class: U	1	95 Dec 31

acrn: AA
ship to: U

descriptive data:
The contractor shall deliver technical effort in accordance with the SOW, dated 13 Aug 94. All data shall be delivered in accordance with Section 5.0 as implemented by the attached SOW.

0004AA	CLIN DEL SCH	sec class: U	1	95 Dec 31

acrn: AA
ship to: U

descriptive data:
The contractor shall deliver support in accordance with the SOW for this order.

0005AF	CLIN DEL SCH acrn: AA ship to: U	sec class: U	1	95 Dec 31

descriptive data:
Technical effort shall be completed in accordance with the SOW dated 13 Aug 94.

5. SECTION G Accounting Classification Data:

ACRN	ACCT CLASS DATA		AMOUNT
AA	Account Establish Unclassified 5743400 304 7434 434419 040000 53475 000000 674400	F74400	$529,669.00

PR # FY7624-94-08723
Descriptive Data: AF Form 616 - H94-SR-243 dated 25 Feb 94 Exp. 25 Sep 94
H94-SR-284 dated 19 Apr 94 Exp. 15 Sep 94

ACCT-CLASS: 5743400-3044-7434-434419-04-53475 674400

6. SECTION J List of Attachments:

Attachments	Title	Date	Pages
1	Statement of Work (SOW)	13 Aug 94	14

7. This order is issued with the following requirements: Contractor will submit to the Government an order specific sub-contracting plan. "within 60 days of the date of receipt of this order".

STATEMENT OF WORK

REMEDIAL INVESTIGATION/FEASIBILITY
TIN CITY AIR FORCE STATION, ALASKA
(94 AUG 13)

I. INTRODUCTION

1.0 PURPOSE

The purpose of this Statement of Work (SOW) is to provide services, technical man-hours and materials for toxic and hazardous contamination studies; water and wastewater treatment plant investigations, geological, geophysical and geotechnical investigations; hydrogeological studies; environmental equipment and landfill leachate monitoring: and environmental waste sites. In addition, this SOW shall provide services for the collection, testing, analysis and reporting of contaminants present in soil, water, and wastewater samples in support of Air Force Hazardous and Toxic Waste Programs.

1.1 SCOPE

1.1.1 In carrying out any work assignment issued, the Contractor shall furnish the necessary personnel, services, equipment, materials, facilities and otherwise do everything necessary for, or incidental to, the performance of work set forth herein.

1.1.2 Primary services shall include, but not be limited to: Services to perform Remedial Investigation/Feasibility Studies (RI/FS) at the Areas of Concern (AOCs) listed in Section 4 of this SOW, for Tin City Air Force Station (AFS), Alaska.

1.1.3 Secondary services incidental to these services include but are not limited to hydrogeologic and geophysical surveys, sampling of soil, tank, drum and pipeline contents, and soil boring surveys necessary to obtain data to establish/verify the extent and parameters of remediation activities.

II. GUIDANCE DOCUMENTS

2.0 HANDBOOK

The Handbook to Support the Installation Restoration Program (IRP) Statements of Work, dated September 1993, referred to in this SOW as "The Handbook," is provided under separate cover as general guidance only. Any reference within the Handbook language regarding compliance and/or formats for reports as a requirement of this Delivery Order shall be considered deleted. If a conflict is identified between this general guidance and any OSWER, U.S. Environmental Protection Agency (EPA), or other regulatory guidance or requirements, the Handbook shall be disregarded. Also, references to requirements for approval for deviations throughout the Handbook shall be considered invalid. Finally, the Method Detection Limits (MDLs) identified in the Handbook are a consolidation of numerous CFR documents which incorporate current EPA requirements. However, the Contractor shall be responsible for any updates in the CFR.

2.1 BACKGROUND GUIDANCE

The following are guidance documents which provide direction for, or otherwise outline, the scope of Air Force major environmental quality activities. These assessments, studies, design activities, and additional related technical activities, as may be required, shall be performed in accordance with rules and regulations set forth by the U.S. Environmental Protection Agency (US EPA),

Occupational Safety and Health Administration (OSHA), Nuclear Regulatory Commission (NRC), Food and Drug Administration (FDA), other federal agencies, individual state regulatory agencies, foreign regulations, international laws, treaties and agreements, as well as applicable requirements of other guidance documents including, but not limited to, the most current versions of the applicable portions of the documents cited below:

a) Occupational Safety and Health Administration (OSHA) regulations.
b) Department of Transportation regulations.
c) National Environmental Policy Act (NEPA).
d) Clean Water Act (CWA).
e) Clean Air Act (CAA).
f) Endangered Species Act (ESA).
g) Toxic Substances Control Act (TSCA).
h) Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments.
i) Comprehensive Environmental Response Compensation and Liabilities Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).
j) National Oil & Hazardous Substances Contingency Plan (NCP), 40 CFR 300.
k) Air Force Engineering Technical Letters (AF ETLs).
l) Guidance for Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties, Interim Final U.S. Environmental Protection Agency (EPA)/540/G-90/001; EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.5-01, 4/90.
m) Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (OSWER Directive 9335.3-01), 1988.
n) Risk Assessment Guidance and Superfund, Volume 1, Human Health Evaluation Manual (Part A), Interim Final (EPA/540/1-89/002), 1989.
o) Risk Assessment Guidance and Superfund, Volume 2, Environmental Evaluation Manual, Interim Final (EPA/540/1-89/001), 1989.
p) Test Methods for Evaluating Solid Waste (SW-846), Third Edition (1986), and 1987 updates.
q) Guidance on Remedial Action for Contaminated Groundwater at Superfund Sites (OSWER Directive 9283.1-2), 1988.
r) A Compendium of Superfund Field Operation Methods, (EPA/540/P-87/001: OSWER Directive 9335.0-14), December 1987.
s) National Fire Protection Association Standards.
t) AFM 88-29, Engineering Weather Data, 1 July 1978.
u) National Standard Plumbing Code.
v) HQ AFCEE Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS), dated September 1993, referred to as "The Handbook".
w) Project-specific Quality Program Plans (QPP), prepared by the Contractor. Includes Sampling and Analysis Plans (SAP), Health and Safety Plans (HSP), and Quality Assurance Project Plans (QAPP).
x) OSWER 9345.0-01, Section 2.0 - Guidance for Conducting New Preliminary Assessments.
y) American Petroleum Institute.
aa) Section 1447(a) of the Safe Drinking Water Act, Public Law 93-523, et. seq.
ab) Executive Order (EO) 12088, Federal Compliance with Pollution Control Standards, 13 October 1978.
ac) Code 40 of Federal Regulations (CFR), Chapter I and V, Protection of Environment.
ad) Air Force Regulations (AFR) 19-1, "Pollution Abatement and Environmental Quality," 9 January 1978.
ae) AFR 19-2, "Environmental Impact Analysis Process (EIAP)," 23 September 1981.

af) AFR 19-6, "Air Pollution Control Systems for Boilers and Incinerators," March 1988.
ag) AFR 19-7, "Environmental Pollution Monitoring," 19 April 1985.
ah) AFR 19-8, "Environmental Protection Committees and Environmental Reporting," August 1988.
ai) AFR 19-9, "Interagency and Intergovernmental Coordination of Land, Facility and Environmental Plans, Programs and Projects," 14 February 1986.
aj) AFR 19-10, "Planning in the Noise Environment," 15 June 1978.
ak) AFR 19-11, "Hazardous Waste Management and Minimization," July 1989.
al) AFR 19-14, "Management of Recoverable and Unusable Liquid Petroleum Products," August 1990.
am) AFR 91-8, "Solid Waste Management," March 1990.
an) AFR 161-17, "USAF Occupational and Environmental Health Laboratory (OEHL) Services," 3 August 1981.
ao) AFR 161-44, "Management of the Drinking Water Surveillance Program," 29 May 1979.
ap) "Defense Environmental Quality Program Policy Memorandum".
aq) E.O. 12316, "Response to Environmental Damage," 14 August 1981.

III. GENERAL REQUIREMENTS

3.0 MEETINGS, CONFERENCES, SITE VISITS

3.0.1 Post Award Meeting. The Contractor shall attend a post award meeting at the base, or other location specified by the Contracting Officer's Representative (AFCEE COR). The purpose of the meeting shall be to familiarize the Contractor with the work and/or hazardous waste sites addressed under this SOW.

3.0.2 Progress Meetings. The Contractor shall attend progress meetings with the base and AFCEE. The Contractor shall be responsible for preparing minutes from each of the meetings.

3.0.3 Design Integration Meetings. Not Applicable.

3.1 SPECIAL NOTIFICATION

3.1.1 Health Risks. The Contractor shall immediately report to the AFCEE COR and the Base Point of Contact (POC), via telephone, any data or results generated during investigations pursuant to this SOW which may indicate any potential imminent health risk to contracted or federal personnel, or the public at large. Following this telephone notification, a written notice with supporting documentation shall be prepared and delivered within three (3) working days. Upon request of the Air Force, the Contractor shall provide pertinent raw laboratory data (i.e. chromatograms) within three (3) weeks of the telephone notification.

3.1.2 Change of Contractor Personnel. An organizational chart displaying key personnel involved in the effort and their respective labor categories shall be submitted with the first monthly Status Report. The Contractor shall notify the AFCEE COR of all professional personnel to work on specific tasks under the delivery order. The Contractor shall notify the AFCEE COR of any significant changes in project personnel, along with the steps that the Contractor is taking to ensure there are no impacts to the schedule or individual tasks.

3.2 LABORATORIES

3.2.1 General. The Contractor shall submit laboratory reporting limits and the methods by which they were derived to the AFCEE COR concurrently along with a laboratory QAPP prior to usage of a laboratory. All laboratories shall be capable of meeting Data Quality Objectives (DQOs)

specified in the project-specific Sampling and Analysis Plan (SAP). All laboratories shall screen for analytes and perform Quality Assurance/Quality Control (QA/QC) requirements as specified in the project/site specific SAP. All analyses shall be reported on a dry weight basis to facilitate comparison with the off-site laboratory data. The analytical capabilities of the all laboratories shall be sufficient for the methods specified in the SAP, and all laboratories shall have sufficient through-put capacity to handle the necessary analytical load during all field activities.

3.2.2 On Site Laboratories. The Contractor may utilize on-site laboratories for screening purposes only. An on-site laboratory may be utilized for the analytical methods required by the approved project/site specific SAP, however, the lab shall meet all state and other applicable certification requirements for the necessary analysis methods prior to its implementation. Laboratory Standard Operating Procedures and QC requirements not included in the current QAPP shall be submitted in the form of a QAPP Addenda for Air Force concurrence. All proposed deviations from the above requirements shall be submitted in writing to the AFCEE COR for concurrence prior to proceeding with the proposed work.

3.3 WORKSITE REQUIREMENTS

3.3.1 Safety Requirements. The Contractor shall provide for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies, and equipment; and avoiding work interruptions. For these purposes, the Contractor shall comply with OSHA safety and health regulations and pertinent provisions of the Air Force Occupational Safety and Health Standards (AFOSH).

3.3.2 Work-site Maintenance. The work-site shall be maintained so as to: 1) prevent the spread of contamination, 2) provide for the integrity of the samples obtained, and 3) provide for the safety of federal workers, contracted personnel, and/or other individuals in the vicinity of the project areas.

The work-site shall be well marked to prevent inadvertent entry into all work areas. Access to work areas shall be monitored and thoroughly controlled. Standard work zones and access points for hazardous waste operations shall be established and maintained as the site conditions warrant. The Contractor shall, at all times, keep the work area free from accumulation of waste materials. The Contractor shall remove non-essential equipment from the work-site when not in use. The work-site shall be maintained to present an orderly appearance and to maximize work efficiency.

Before completing the work at each sampling site, the Contractor shall remove, from the work premises, any rubbish, tools, equipment, and materials that are not property of the Government. Upon completing the work, the Contractor shall leave the area clean, neat, orderly, and return work sites to the original condition. The Contractor shall also ensure compliance with any federal and state regulations for decontaminating tools, equipment, or other materials, as required.

3.3.3 Operations Impact Minimization. The Contractor shall mark the field locations of all points of ground penetration during the planning/mobilization phase of the field investigation. The base POC shall be consulted to properly position sampling locations (wells, borings, soil gas probes, etc.) with respect to site locations, to minimize the disruption of base activities, and to avoid penetrating underground utilities. Additionally, the Contractor may be required to coordinate with other base personnel to attain these objectives. The Contractor shall provide for the detection of underground utilities independent of base Civil Engineering services utilizing geophysical or other techniques. All necessary permits shall be obtained from 11th CEOS for boreholes and excavations, and necessary coordination shall be completed, prior to commencement of individual sampling operations. Frequent communication and coordination with base personnel shall be necessary to accomplish these goals.

3.3.4 Storage. The Contractor shall be responsible for the security of his equipment. The Contractor shall provide temporary facilities as required for storage of his equipment. Equipment or materials used in the work, and any Contractor-furnished temporary facilities, requiring storage on site, shall be placed at sites as designated by the Base POC. The Contractor shall be responsible for security and weather proofing of any stored material and equipment. Missing or damaged material shall be replaced at no additional cost to the Government. At the completion of the work, all temporary fences and structures (that the Contractor used to protect materials and equipment) shall be removed from the base. The Contractor shall clean the storage area of all debris and material and perform all repairs as required to return the site to its original condition.

3.3.5 Security. The Contractor is responsible for obtaining and monitoring contractor security badges for all areas for the duration of this contract. All security badges or passes shall be returned to the Base POC upon expiration of the badge, upon completion of the project, or when possession of the badge is no longer necessary (e.g., upon removal of contracted personnel from specific projects). Photography of any kind must be coordinated through the Base POC or Base Disposal Agency representative.

3.4 WORK BREAKDOWN STRUCTURE

The Contractor shall prepare proposals, project schedules, and monthly financial reports organized according to the following work breakdown structure (WBS):

5 PRELIMINARY ASSESSMENT/SITE INVESTIGATION Not Applicable.

10 REMEDIAL INVESTIGATION/FEASIBILITY STUDY

10.01 RI/FS Scoping
10.02 Development of Alternatives
10.03 Site Characterization
10.04 Screening of Alternatives
10.05 Treatability Investigation
10.06 Analysis of Remedial Alternatives
10.07 Remedy Selection
10.08 Groundwater Monitoring Wells
10.09 Sampling and Analysis
10.10 Site-work and Utilities

20 REMEDIAL DESIGN Not Applicable.

IV. WORK TASKS

The work shall be accomplished at Tin City AFS, Alaska. The work shall include, but not be limited to:

4.0 PLAN DEVELOPMENT

The Contractor shall prepare for approval by the AFCEE COR a Quality Assurance Project Plan (QAPP) for this work. In addition, the Contractor shall prepare a project specific schedule, Work Plans (WP), Management Action Plan (MAP), Sampling and Analysis Plan (SAP) including a Field Sampling Plan (FSP), Community Relations Plans (CRPs), and discretely itemized cost estimate. The Contracting Officer (CO), the AFCEE COR, and the Base POC shall be notified in writing prior to any modification to, or deviation from, any activity described in these documents.

4.1 SCOPING

4.1.1 Pre-survey. The Contractor shall conduct a pre-survey to enable preliminary scoping of environmental issues. The Contractor shall visit the assigned site(s) and make all preliminary studies of monitoring or sampling locations and accessibility, number of sampling locations, number and type of personnel required, number and type of tests or samples desired, special or modified sampling equipment and procedures required, personal protective equipment required, and type of analytical protocol or procedures to assure that the survey activities shall comply with applicable regulations, laws, or standards. For the Pre-survey activities, the Contractor shall designate a field team leader to implement activities and coordinate communication with the Base POC, the Technical Onsite Surveillance Representative and the COR.

4.1.2 Pre-mobilization Survey. Not Applicable.

4.2 PRELIMINARY ASSESSMENT/SITE INVESTIGATION (PA/SI) Not Applicable.

4.2.1 Preliminary Assessment (PA). Not Applicable.

4.2.2 Site Investigation (SI). Not Applicable.

4.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)

4.3.1 Remedial Investigation (RI). The Contractor shall conduct a RI to characterize environmental conditions, define the nature and extent of contamination, and quantitatively estimate the risk to human health and the environment at five sites at Tin City AFS through the collection of geologic, geophysical, hydrogeological, ecological, chemical, physical, and hydrologic data, and environmental samples; the laboratory analysis of those samples for potential contaminants; the evaluation of the analytical results and field measurements with respect to quality control data; and the interpretation and analysis of validated data. The purpose of data collection, sample collection, and laboratory analysis is to determine whether any contaminants generated from installation activities have entered the environment and pose a risk to human health or the environment. The following list documents sites and areas of concern for the RI/FS:

1) DP-011 Dump No. 3 at Beach
2) ST-012 Four USTs
3) SS-013 Spill/Leak No. 3 at LTT
4) SS-014 Spill/Leak No. 4 near Building 110
5) AOCs Includes, but is not limited to, the Garage, Incinerator, Power Plant, and Pump House

4.3.2 Feasibility Study (FS). The FS is performed concurrently with the RI. As much of the FS as possible shall be performed early on in the RI/FS process and refined as additional RI data are obtained. The Contractor shall use the information from the RI and the baseline risk assessment to develop and evaluate remedial action alternatives for each site where a threat to human health or the environment exists. Follow the procedures specified in USEPA OSHA Directive 9355.3-01, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA." Employ streamlining methods wherever possible. Very few alternatives are viable in Arctic conditions, study only those applicable to extreme cold. Develop and evaluate the minimum number of alternatives needed to provide a range of promising treatment, and containment actions. Eliminate impracticable alternatives from further consideration early in the FS process. The scope and level of detail shall be consistent with the nature and complexity of site problems.

4.4 REMEDIAL DESIGN (RD) Not Applicable.

4.5 TREATABILITY STUDIES, PILOT TESTS, BENCH SCALE TESTS Not Applicable.

4.6 SUBTASKS

The Contractor shall perform the following sub-tasks including, but not limited to, the following:

4.6.1 Conceptual Site Model. For each site, use validated data supported by acceptable QA/QC results (as measured against QAPP requirements) and site characterization information to develop or refine, based on newly collected data, the conceptual site model. The model shall define the nature and extent of contamination, the hydrogeologic regime, and the transport and fate of those contaminants. The conceptual site model shall comply with the minimum requirements given in Section 2 of the Handbook. The complexity and detail of the site model shall be consistent with the nature of the site and site problems, and the amount of data available. Use the conceptual site model in the baseline risk assessment.

4.6.2 Ecological/Baseline Risk Assessment. For each site, use validated data supported by acceptable QA/QC results (as measured against QAPP requirements) and the conceptual site model to estimate numerically the risk posed by site contaminants to public health and the environment. Use the methodology in Section 2 of the Handbook. Identify all Applicable or Relevant and Appropriate Requirements (ARARs) that were not identified in previous reports for those contaminants detected in environmental samples at each site. Provide the results of the baseline and/or ecological risk assessment in the Remedial Investigation (RI) Report using the formats in the Handbook.

Identify those sites posing minimal or no threat to human health, welfare, or the environment and for which no further action is appropriate. Use the results of the risk assessment in establishing remedial action objectives and developing remedial alternatives in the Feasibility Study.

4.6.3 Alternatives Development. Establish remedial action objectives and remediation goals for protecting human health and the environment. These objectives and goals shall be determined based on identified ARARs and acceptable exposure levels as defined in the baseline risk assessment, and refined throughout the RI/FS process. Identify general response actions, applicable technologies based on site and contaminant conditions, and combine technologies to formulate distinct alternatives. Develop alternatives which eliminate, control, and /or reduce risk to human health or the environment to acceptable levels for each pathway. Where a wide variety of promising alternatives exist, screen the alternatives based on effectiveness, ease of implementation, and cost. Detail the process of development and screening of alternatives, and identify the alternatives selected for detailed analysis.

4.6.4 Alternatives Analysis. Conduct a detailed analysis of each alternative selected and identified in para 2.3.15, and approved by the AFCEE COR. There are a limited number of alternatives due to the extreme cold. Using the methodology in OSWER Directive 9355.3-01, evaluate each alternative against US EPA's nine criteria for conducting Feasibility Studies. In addition to the individual assessment, perform a comparative analysis to determine the relative performance of alternatives. Focus the analysis on sub-factors and criteria most pertinent to each site and the scope and complexity of the proposed action. Select a recommended alternative for each site or operable unit. Provide a summary of the detailed analysis of alternatives following task completion. Include summary tables of the individual and comparative analysis that shall be used in the Remedial Investigation Report. For those sites or zones where sites are grouped together, where a preferred alternative is identified, prepare a decision document after the receipt of Air Force review comments on the Remedial Investigation Report to support the selection process. Use the format specified in Section 3 of the Handbook.

4.6.5 Evaluation of Remedial Systems and Environmental Equipment. Not Applicable.

4.6.6 Administrative Record. The Contractor shall prepare, compile, and maintain an Administrative Record containing pertinent information regarding response selections. The Administrative Record shall consist of documents and correspondence as dictated by the national Oil and Hazardous Substances Pollution Contingency Plan (NCP). This task shall consist of two parts. The first is to determine what documents and information should be included in the record, and to develop a proposed filing or organizing system. Present this information in an Administrative Record letter report. The second part of this task is to compile three bound copies and one microfiche copy of the Administrative Record, including all reports, documents, correspondence, and other information currently available. The bound copies shall be maintained in the Base Environmental Coordinator's office. The second part of this task shall not proceed until after AF review of the Administrative Record letter report and at the direction of the COR.
The Administrative Record for selection of remedial action generally should consist of documents which were considered or relied on to select remedial actions for this project, past projects, future projects, and documents which demonstrate the public's opportunity to participate and comment on the selection of remedial actions. Typically, the Administrative Record should consist of the type of documents listed below. This list is neither a statement of requirements or all-inclusive; rather, the record should include any documents which meet the general criteria described above.

a. Factual Information/Data.
- Preliminary Assessment (PA) Report
- Site Inspection (SI) Report
- Remedial Investigation/Feasibility Study (RI/FS) Work Plans
- Sampling and Analysis Plans (SAP), consisting of Quality Assurance Project Plan (QAPP) and Field Sampling Plans (FSP)
- Technical studies performed for sites and related documentation
- Endangerment Assessment/Risk Assessment and related documentation

b. Policy and Guidance Information.

c. Public Participation Information.
- Community Relations Plan (CRP)

d. Enforcement Documents.
- Administrative orders
- Consent decrees
- Interagency Agreements (IAG)

e. Decision Documents.

f. Other Information.
- Index
- Documentation of State involvement
- Health Assessments and studies

4.7 OTHER ENVIRONMENTAL ACTIVITIES: Not Applicable.

4.8 DELIVERABLES

4.8.1 Scoping, Planning Documents.

4.8.1.1 Monthly Financial and Management Reports. The Contractor shall submit financial and management reports utilizing the standardized Work Breakdown Structure per paragraph 3.4 of this SOW to describe the status of expenditure of funds correlated with the progress of the work completed. Reports shall provide current status and projected requirements of funds, man-hours, and work completion; indicate the progress of work and the status of the program and assigned tasks; and inform of existing or potential problem areas. (A001, A002, A003A)

4.8.1.2 Health and Safety Plan. The Contractor shall prepare and deliver a Health and Safety Plan to comply with USAF, OSHA, US EPA, state, and local health and safety regulations regarding the proposed work effort. The Contractor shall utilize to the fullest extent possible existing corporate Health and Safety Plans, tailoring them to the current effort, use US EPA guidelines for designating the appropriate levels of protection needed at the study sites, coordinate the Health and Safety Plan directly with applicable regulatory agencies prior to submittal to AFCEE, and provide the AFCEE COR with evidence of Health and Safety Plan coordination prior to the start of field work. The Contractor shall certify to AFCEE that it has reviewed the approved Health and Safety Plan with each employee and subcontractor's employees prior to the time each employee engages in field activities. The HASPs shall be submitted with, and follow the same review cycles as, the WPs and SAPs. (A004A)

4.8.1.3 Management Action Plan. In accordance with paragraph 4.0, the Contractor shall deliver a Management Plan to describe the overall approach, major tasks and scope, time sequencing of events, and major decision points to complete all IRP efforts to ensure consistency with the NCP. This Plan is intended as a planning document and management tool to track the progress of IRP efforts. (A005A)

4.8.1.4 Community Relations Plan. In accordance with paragraph 4.0, the contractor shall deliver a Community Relations Plan (CRP), outlining the specific public communication and involvement techniques to be used in coordination with remedial site activities. The Contractor shall follow the guidance contained in OSWER Directive 9230.0-3b, "Community Relations in Superfund, A Handbook", and propose a detailed format for the CRP consistent with this guidance for AF and AFCEE approval prior to preparing the plan. The CRP shall include a description of the site and the community, an overview of the community involvement to date, key community concerns regarding the site and AF site activities. A list of elected officials, agency representatives, and interested groups and individuals shall be included. Contractor activities to develop the CRP shall include conducting a review of site information provided by the base, preparing for and conducting (with AF and US EPA personnel) one-on-one community information needs, preparing fact sheets quarterly, and attending public meetings. (A005B)

4.8.1.5 Cost Estimates. Not Applicable.

4.8.1.6 Work Plans.

4.8.1.6.1 RI/FS Work Plan. In accordance with paragraphs 3.4 and 4.0, the Contractor shall deliver a work plan for the RI/FS. Section 1 of the Handbook may be used as guidance. (A005C)

4.8.1.6.2 Remedial Design Work Plan. Not Applicable.

4.8.1.7 Quality Assurance Project Plans (QAPPs).

4.8.1.7.1 General QAPP. Not Applicable.

4.8.1.7.2 RI/FS Project/Site Specific QAPP. As a component of the SAP, the Contractor shall deliver a project/site specific QAPP in accordance with paragraph 4.0 of this SOW. The Handbook may be used as guidance. (A007A)

4.8.1.8 RD Title II Associate Contractor Agreement and Plan Evaluation Report. Not Applicable.

4.8.1.9 Sampling and Analysis Plan (SAP). The Contractor shall deliver and comply with the SAP per paragraph 4.0 of this SOW. The Handbook may be used as guidance. (A007B)

4.8.1.10 Field Sampling Plan (FSP). As a component of the SAP described in Section 4.8.1.9 of this SOW, the Contractor shall deliver and comply with a FSP in accordance with Section 4.0 of this SOW. The Handbook may be used as guidance. The FSP shall be considered as an evolving document by which the Contractor provides recommendations and then incorporates Air Force acceptance for field sampling and analysis. The Contractor shall submit an annotated outline of each section of the FSP for approval by the AFCEE COR prior to preparation of the report. The Contractor shall prepare the report as specified in the accepted annotated outline. All sampling and analysis recommendations shall include the Contractor's supporting rationale. Upon Air Force acceptance of sampling and analysis recommendations, a phased FSP shall be compiled. The FSP shall include sufficient data to support recommendations and a description of the work to be conducted. The FSP shall be updated by site as phase recommendations are accepted by AFCEE. A prime objective shall be to incorporate AFCEE comments in an on-going manner and thereby minimize the volume of comments on the working copy and final submittals. The Contractor shall cite the Base-specific QAPP as a reference document, but completely describe any modifications or additions to the content of these documents. (A007C)

4.8.1.11 Long Term Groundwater Sampling Plan. Not Applicable.

4.8.1.12 Test Plans (TPs). Not Applicable.

4.8.1.13 Schedules.

4.8.1.13.1 RI/FS Project Schedules. In accordance with paragraph 4.0 of this SOW, the Contractor shall deliver a computer generated network analysis which is a detailed task plan for all WBS tasks for approval by the AFCEE COR. The Network Analysis (e.g., GANTT, PERT, CPM) shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the performance period of the SOW. The Network Analysis shall show both serial and parallel sub-tasks leading to a deliverable product/report, and shall show early and late start and completion date with float. (A013)

4.8.1.13.2 Remedial Design Project Schedule. Not Applicable.

4.8.1.13.3 Remedial Action Project Schedule. Not Applicable.

4.8.2 Primary Documents. All primary documents shall be prepared and submitted in draft, draft final, and final form. Provide microfiche copies of each final primary document at the direction of the AFCEE COR. Draft and final written responses to comments received on draft primary documents shall be provided. The following primary documents shall be provided as specified in this SOW:

4.8.2.1 Technical Reports.

4.8.2.1.1 Preliminary Assessment/Site Investigation (PA/SI Report). Not Applicable.

4.8.2.1.2 Remedial Investigation (RI) Report. In accordance with paragraph 4.3.1, the Contractor shall prepare a Remedial Investigation Report in accordance with OSWER 9355.3-01, "Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA," October 1988. The Report shall include results of the baseline risk assessment and reflect regulatory agency comments to the corresponding Site Characterization Summaries. (A005D)

4.8.2.1.3 Feasibility Study (FS) Report. In accordance with paragraph 4.3.2, a Feasibility Study Report shall be prepared in accordance with OSWER 9355.3-01, "Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA," October 1988. The Report shall include the detailed analysis of alternatives and reflect regulatory agency comments to

the corresponding Screening of Alternatives Technical Report. The FS report shall be a separate report from the RI report. (A005E)

4.8.2.3 Records of Decision (ROD). The Contractor shall deliver separate RODs, which shall be prepared using the format in OSWER 9355.3-02. (A005F)

4.8.2.4 Engineering Evaluation/Cost Analysis (EE/CA). Not Applicable.

4.8.2.5 Administrative Record Index. In accordance with paragraph 4.6.6, the Contractor shall deliver an Administrative Record Index. (A004B)

4.8.2.6 Title I Design Documents. Not Applicable.

4.8.2.7 Remedial Design Title II Documents. Not Applicable.

4.8.3 Secondary Documents. Secondary documents are used as input to subsequent primary documents. Draft secondary documents shall be prepared and submitted for review and comment. Following receipt of comments to draft secondary documents, a draft written response to each comment shall be provided for Air Force review. The draft written responses shall be revised based on Air Force input, and final responses shall be provided. The following secondary documents shall be provided:

4.8.3.1 Informal Technical Information Reports (ITIRs).

4.8.3.1.1 Analytical Data ITIR. Submit all analytical data, including QC results and cross reference tables, in a hard and/or electronic copy ITIR. (A004C)

4.8.3.1.2 Accelerated Remediation Project Definition ITIR. Not Applicable.

4.8.3.1.3 Conceptual Site Model ITIR. The Conceptual Site Model will be presented in the appendix of the RI report.

4.8.3.1.4 Site Characterization Summary - (SCS-ITIR). Not Applicable.

4.8.3.1.5 Ecological and Baseline Risk Assessment ITIR. The Risk Assessment shall be discussed in the RI report.

4.8.3.1.6 Remedial Systems and Environmental Equipment ITIR. Not Applicable.

4.8.3.2 Initial Screening of Alternatives (ISA) Report. The ISA will be discussed in the FS report.

4.8.3.3 Detailed Analyses of Alternatives (DAA) Report. The DAA will be incorporated into the FS report.

4.8.3.4 Installation Restoration Program Information Management System (IRPIMS) Not Applicable

4.8.3.5 Letter Reports.

4.8.3.5.1 General. The Contractor shall deliver letter reports. The purpose of the letter reports is to provide data and the Contractors evaluation of the data to enable the AFCEE COR and base POC to be involved in the decisions based on that data. The letter report shall briefly describe the task performed, the Contractor's evaluation of the data collected, and recommendations

for subsequent tasks. All data collected as part of this task shall be provided as an attachment to the letter report. (A004D)

4.8.3.5.2 Health Risk. In accordance with paragraph 3.1.1, the Contractor shall deliver letter reports concerning imminent health risks encountered. (A015)

4.8.3.6 Environmental Report. Not Applicable.

4.8.3.7 Presentation Materials. The Contractor shall prepare and present briefing packages at meetings coordinated by the Air Force. As part of the presentation materials, the Contractor shall deliver paper copies of all slides and overheads. (A010)

4.8.3.8 Photo Documentation. Not Applicable

4.8.3.9 Community Relations Newsletters/Fact Sheets. The Contractor shall deliver community relations newsletters/fact sheets, prepared IAW guidance in OSWER 92390.0-3B, and base-specific Community Relations Plans. (A011)

4.8.3.10 Meeting Minutes. The Contractor shall be responsible for generating meeting minutes documenting all items discussed at the meetings, and shall include a list of meeting attendees. (A012)

4.8.3.11 Contractor Personnel Chart. Per paragraph 3.1.2, the Contractor shall deliver and update Contractor personnel charts. (A003B)

V. DATA

5.0 DATA MANAGEMENT

The Contractor shall collect, prepare, publish, and distribute the data in the quantities and types designated on the Contract Data Requirements List (CDRL). The Contractor shall designate a focal point who shall integrate the total data management effort and manage changes, additions or deletions of data items. In addition, the Contractor shall identify items to be added, recommend revisions or deletion of items already listed on the CDRL as appropriate, and maintain the status of all data deliverables.

5.1 DATA DELIVERABLES

Deliverables shall be in accordance with the CDRLs applicable to this SOW.

Sequence	Para. No.	(Freq.) Blk 10	(As of) Blk 11	(First Sub.) Blk 12	(Subsqnt Submittals) Blk 13	(Notes) Blk 14
A001 P&C Reports	4.8.1.1	MTHLY	EOM	20 DOM	MTHLY	A
A002 Man-hour Expenditure	4.8.1.1	MTHLY	EOM	20 DOM	MTHLY	A
A003A Status Report	4.8.1.1	MTHLY	EOM	20 DOM	MTHLY	A
A004A HSP	4.8.1.2	ONE/2R	N/A	9 ~~6~~0 DAC	30 DARC	B
A005A MAP	4.8.1.3	ONE/2R	N/A	120 DAC	30 DARC	B
A005B CRP	4.8.1.4	ONE/2R	N/A	90 DAC	30 DARC	B
A005C RI/FS Work Plan	4.8.1.6.1	ONE/2R	N/A	90 DAC	30 DARC	B
A007A QAPP	4.8.1.7.2	ONE/2R	N/A	90 DAC	30 DARC	B
A007B SAP	4.8.1.9	ONE/2R	N/A	90 DAC	30 DARC	B
A007C FSP	4.8.1.10	ONE/2R	N/A	90 DAC	30 DARC	B
A013 Project Schedule	4.8.1.13.1	QTRLY	EOQ	15 DAQ	QTRLY	B
A005D RI Report	4.8.2.1.2	ONE/2R	N/A	120 DACF	30 DARC	B
A005E FS Report	4.8.2.1.3	ONE/2R	EOF	150 DACF	30 DARC	B
A005F RODs	4.8.2.3	ONE/2R	EOF	200 DACF	30DARC	B
A004B Admin. Record Index	4.8.2.5	ONE/R	N/A	90 DAC	30DARC	B
A004C Analytical ITIR	4.8.3.1.1	OTIME	EOF	60 DAVD	N/A	B
A004D Letter Report	4.8.3.5.1	ASREQ	N/A	ASREQ	N/A	B
A015 Health Risk	4.8.3.5.2	ASREQ	N/A	ASREQ	N/A	B
A010 Presentation Materials	4.8.3.7	ASREQ	N/A	10 DPTM	N/A	B
A011 CR News/Fact Sheets	4.8.3.9	ASREQ	N/A	ASREQ	ASREQ	B
A012 Meeting Minutes	4.8.3.10	ASREQ	N/A	5 DAM	N/A	B
A003B Contr. Personnel Chart	4.8.3.11	ASREQ	N/A	ASREQ	N/A	B

Legend:

DAC	- Days after contract
DARC	- Days after receipt of comments
EOM	- End of month
(X) DOM	- On the (X) calendar day of the month
EOQ	- End of calendar year quarter
(X) DAQ	- On the (X) calendar day after the end of the quarter
(X) DPTM	- (X) calendar days prior to meeting
(X) DAM	- On the (X) calendar day after meeting
(X) DAVD	- On the (X) calendar day after receipt of validated data
(X) DACF	- On the (X) calendar day after completion of field effort
MTHLY	- Monthly
QTRLY	- Quarterly
EOF	- End of Field Effort
OTIME	- One Time
ONE/R	- One with revision
ONE/2R	- One with 2 revisions
ASREQ	- As required
N/A	- Not applicable

Notes:

A - Distribute in accordance with basic contract.
B - Number of Deliverable Copies and drafts shall be established by the AFCEE COR

VI. GOVERNMENT FURNISHED PROPERTY

6.1 The Handbook to Support the Installation Restoration Program Statements of Work (SOW), Volume I. The latest version of the Handbook is dated September, 1993.

VII. GOVERNMENT POINTS OF CONTACT

The Government Points of Contact will be provided under a separate cover.

Appendix C

Soil Boring Logs

MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB B3	1 OF 1

PROJECT TIN CITY LRRS SITE B (AOC 1) CLIENT AFCEE GEOLOGIST John D.

DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELVEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		70	20	10	6	GW-GM		1900	■	WELL GRADED GRAVEL WITH SILT AND SAND - dark brown, moist, medium dense, fine to coarse-grained sand, fine to coarse rounded gravel, surrounded cobbles, apparent fill material from surf zone

Boring terminated at 1.0' due to auger refusal.
No groundwater encountered.
Back-filled with bentonite / cuttings mixture
No odor by olfactory.

NORTH

SB B3

PH

LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

SOIL BORING LOG

MONTGOMERY WATSON, Anchorage, Alaska

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB B4	1 OF 1

PROJECT: TIN CITY LRRS SITE: B (AOC 1) CLIENT: AFCEE GEOLOGIST: John D

DATE: 7-11-95 WEATHER: Overcast LOCATION COORDINATES: (Northing) (Easting) ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: ~~HSA~~ HA BORING SIZE: 4" HAMMER DROP (IN/LBS): — RIG TYPE: — DRILLER/COMPANY: MW

SAMPLES: 1 SAMPLE TYPE: Split-spoon SAMPLER TYPE/DIAMETER: Grab TOTAL DEPTH (FT): see bottom of log DEPTH TO SWL (FT): — TOP OF HOLE ELVEVATION:

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		70	20	10	6	GW-GM		1915	■	WELL GRADED GRAVEL WITH SILT AND SAND - dark brown, moist, medium dense, fine to coarse-grained sand, fine to coarse rounded gravel, subrounded cobbles, apparent fill material from surf. zone, 3" layer of peat at 0.8' stained black
1										
2										
3										
4										
5										
6										Boring terminated at 1.0' due to auger refusal. No groundwater encountered. Backfilled with bentonite/cuttings mixture. Soil odorous by olfactory at 0.5'.
7										
8										
9										
10										
11										
12										
13										
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16										
17										
18										
19										
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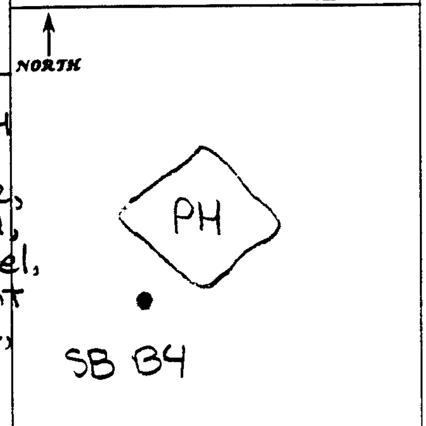
21										



LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB B5	1 OF 1

PROJECT TIN CITY LRRS SITE B (AOC 1) CLIENT AFCEE GEOLOGIST John D

DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES ______ (Northing) ______ (Easting) ELEVATION DATUM ______ (MSL/Other)

DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		20	75	5	6	SP		1930	■	POORLY GRADED SAND WITH GRAVEL - dark brown, moist, medium dense, fine-grained sand, some medium and coarse-grained sand, fine to coarse subangular to rounded gravel, subrounded cobbles, apparent fill material, iron oxide staining on surface
1										
2										
3										
4										
5										
6										Boring terminated at 1.0' due to auger refusal. No groundwater encountered. Backfilled with bentonite / cuttings mixture. Soil odorous by olfactory at 0.5'
7										
8										
9										
10										
11										
12										
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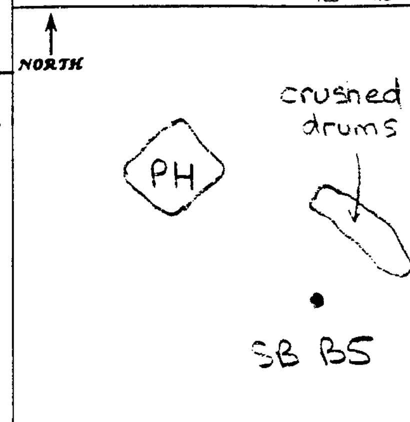
14										
15										
16										
17										
18										
19										
20										
21										



LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB B6

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE B (AOC 1) CLIENT AFCEE GEOLOGIST John D.

DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

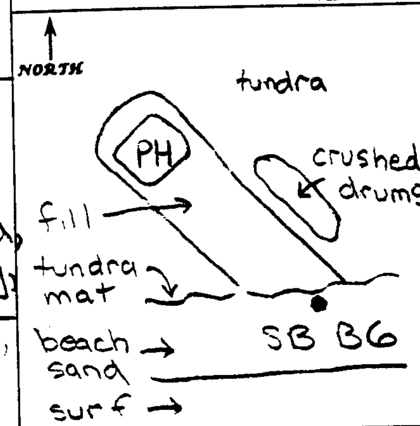
DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) – RIG TYPE – DRILLER/COMPANY MW

SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) 0.6 TOP OF HOLE ELVEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		0	100	0	–	SP		1945	■	POORLY GRADED SAND - brown, moist, loose, fine to medium-grained sand, trace coarse-grained sand, some iron-oxide staining, beach sand
		0	40	60	–	CL				SANDY CLAY - light brown, very moist to saturated at 0.6', soft, fine to medium-grained sand, native soil

Boring terminated at 1.0'
Groundwater encountered at 0.6'
Backfilled with bentonite/cuttings mixture
Soil odorous by olfactory at 0.5'



LOCATION SKETCH

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB C1

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE C (ST 12a) CLIENT AFCEE GEOLOGIST John D

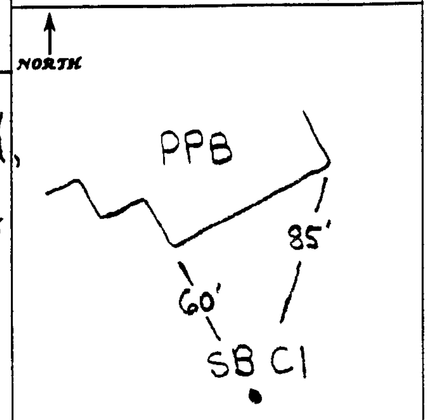
DATE 7-16-95 WEATHER Fog - Wind LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		10	40	50	1	ML				SANDY SILT - brown, slightly moist, soft, fine-grained sand, fine to coarse subrounded gravel, apparent fill, apparent sewage odor, color change to olive green at 2'
4	6						11	1545		
5	12 20 65	60	30	10	3	GW-GM				WELL GRADED GRAVEL WITH SILT AND SAND - olive brown, slightly moist, very dense, fine-grained sand, fine to coarse subangular gravel, apparent fill, apparent sewage odor difficult drilling - drill bit fracturing cobbles
9										Boring terminated at 9' due to auger refusal. Backfilled with bentonite/cuttings mixture. No groundwater encountered



LOCATION SKETCH

"Boulders above bedrock" - "Cruddy fill"
During grading, the larger ripped-up rocks would be placed on top of bedrock and in depressions. Finer fill material used for surfacing.

Note:
"Due to auger refusal" usually means due to the presence of bedrock or boulders above bedrock, which can be penetrated (limestone) but with much difficulty. Bedrock in most instances, is the most logical explanation. Logs should provide some detail upon "hitting" bedrock.

JOB No. 0000.0000 ...me: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB C2 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE C (ST 12a) CLIENT AFCEE GEOLOGIST

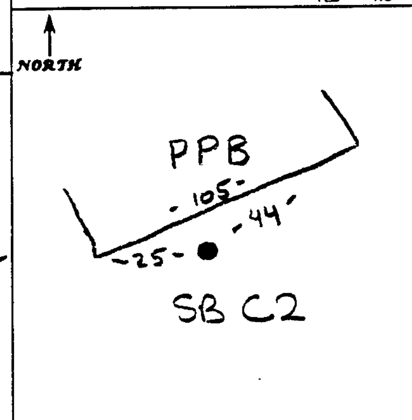
DATE 7-14-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 6 1/4" ID HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELVEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		20	75	5	2	SP				POORLY GRADED SAND WITH GRAVEL - brown, moist, medium dense, fine to medium grained sand, fine to coarse subrounded gravel, apparent fill, no odor
4	3						270	1320		
5	4									limestone cobble
	2									
6	10						582	1345		very moist - freeze-thaw zone
	31									frozen
7	30	5	90	5	2	SP				POORLY GRADED SAND - brown, frozen, very dense, medium-grained sand, fine to coarse subrounded gravel, no odor
9										Boring terminated at 8'. Backfilled with bentonite/cuttings mixture. No groundwater encountered



LOCATION SKETCH

JOB No. 0000.000u Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB B1

SHEET 1 OF 1

PROJECT: TIN CITY LRRS SITE: B (AOC 1) CLIENT: AFCEE GEOLOGIST: John D.

DATE: 7-11-95 WEATHER: Overcast LOCATION COORDINATES: (Northing) (Easting) ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: ~~HSA~~ HA BORING SIZE: 4" HAMMER DROP (IN/LBS): — RIG TYPE: — DRILLER/COMPANY: MW

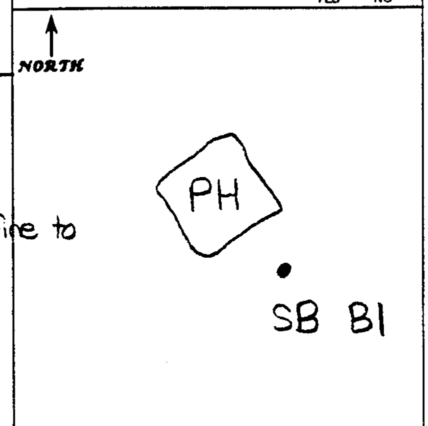
SAMPLES: 1 SAMPLE TYPE: Split-spoon SAMPLER TYPE/DIAMETER: Grab TOTAL DEPTH (FT): see bottom of log DEPTH TO SWL (FT): 0.2 TOP OF HOLE ELEVATION:

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–1		70	20	10	6	GW-GM		1830	■	WELL GRADED GRAVEL WITH SILT AND SAND - dark brown, very moist to saturated at 0.2', med. dense, fine to coarse-grained sand, fine to coarse rounded gravel, subrounded cobbles, seepage in hole at 0.2', apparent product sheen, apparent fill material from surf zone

Boring terminated at 0.5'
Groundwater encountered at 0.2'
Backfilled with bentonite / cuttings mixture
Soil odorous by olfactory at 0.1'

LOCATION SKETCH



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MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB B2

SHEET 1 OF 1

PROJECT: TIN CITY LRRS   SITE: B (AOC 1)   CLIENT: AFCEE   GEOLOGIST: John D

DATE: 7-11-95   WEATHER: Overcast   LOCATION COORDINATES: (Northing) (Easting)   ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: ~~HSA~~ HA   BORING SIZE: 4"   HAMMER DROP (IN/LBS): —   RIG TYPE: —   DRILLER/COMPANY: MW

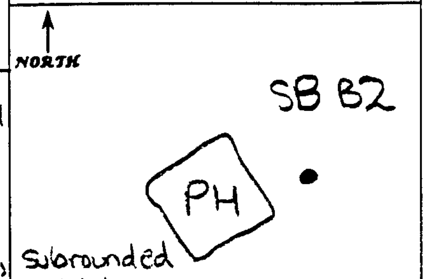
SAMPLES: 1   SAMPLE TYPE: Split-spoon   SAMPLER TYPE/DIAMETER: Grab   TOTAL DEPTH (FT): see bottom of log   DEPTH TO SWL (FT): —   TOP OF HOLE ELEVATION:

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–1		70	20	10	6	GW-GM		1845	■	WELL GRADED GRAVEL WITH SILT AND SAND - dark brown, moist, medium dense, fine to coarse-grained sand, fine to coarse rounded gravel, subrounded cobbles, apparent fill material from surf zone, 2" layer of red brown peat at 0.6', apparent black staining

Boring terminated at 1.0' due to auger refusal.
No groundwater encountered
Backfilled with bentonite/cuttings mixture
Soil odorous by olfactory at 0.5'

LOCATION SKETCH



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MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB C2a

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE C (ST 12a) CLIENT AFCEE GEOLOGIST John D

DATE 7-14-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 6 1/4" ID HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

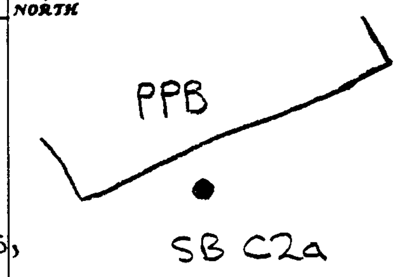
DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		20	75	5	2	SP				POORLY GRADED SAND WITH GRAVEL - brown, moist, medium dense, fine to medium grained sand, fine to coarse subrounded gravel, trace fibrous debris, apparent fill, no odor
8	50	5	90	5	2	SP		1130		POORLY GRADED SAND - brown, very moist to saturated, medium dense, medium grained sand, fine to coarse subrounded gravel, apparent hydrocarbon odor, no recovery beyond 6" due to boulders? bedrock? pulverized limestone on drill bit

Boring terminated at 10' due to auger refusal
Backfilled with bentonite/cuttings mixture
SP at 7.5' possible blanket below former tank
Decide to step hole over to re-sample (3'E, 3'N)
No samples submitted to laboratory from this boring.

It is possible that the tank excavation backfill has acted like a sump for the collection of water. According to Brett it is likely the sand was placed as a "cushion" before setting the former tank.

Exploratory Only

NORTH



LOCATION SKETCH

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MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020
BORING NO.: SB C3
SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE C (ST 12a) CLIENT AFCEE GEOLOGIST John D

DATE 7-14-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELVEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	45	40	1	SM				SILTY SAND WITH GRAVEL light brown, slightly moist, medium dense, fine grained sand, fine to coarse sub-rounded gravel, apparent fill, no odor, color change to olive brown at 3'
1										
2										
3										
4	2						175	1530	■	
5	16 18 18								■	limestone - characteristic blue color, pulverized in sampler
6										
7										Boring terminated at 6' Backfilled with bentonite / cuttings mixture. No groundwater encountered.
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
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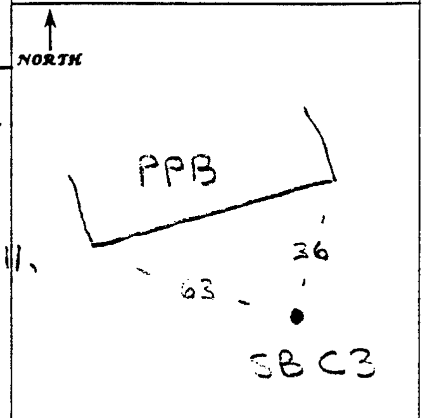
21										



LOCATION SKETCH

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MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB C3a	1 OF 1

PROJECT TIN CITY LRRS SITE C (ST 12a) CLIENT AFCEE GEOLOGIST John O.

DATE 7-14-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 6¼" ID HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

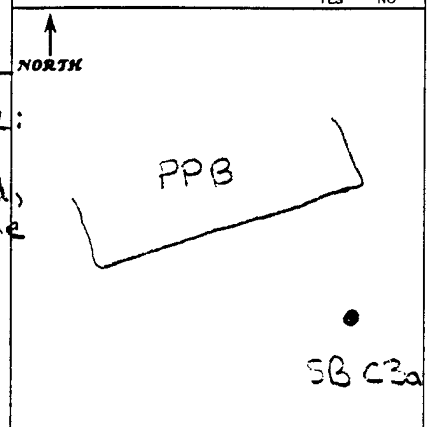
SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 2½ ID TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELEVATION

DEPTH (FEET)	BLOWS (6 IN.)	GRAIN SIZE % GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	45	40	1	SM				SILTY SAND WITH GRAVEL: light brown, slightly moist, medium dense, fine grained sand, some coarse-grained sand, fine to coarse rounded gravel, apparent fill, no odor.
3										color change to olive brown
4								1435	X	limestone cobble
6										difficult drilling
7										pulverized limestone as cuttings
9										

Boring terminated at 9'
Backfilled with bentonite / cuttings mixture.
Decide to step-out boring location to re-sample (4'W)
No groundwater encountered
No samples submitted to laboratory from this boring

Exploratory Only

WELL COMPLETED? YES ☐ NO ☒



LOCATION SKETCH

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MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB C4	1 OF 1

PROJECT TIN CITY LRRS SITE C (ST 12a) CLIENT AFCEE GEOLOGIST John D

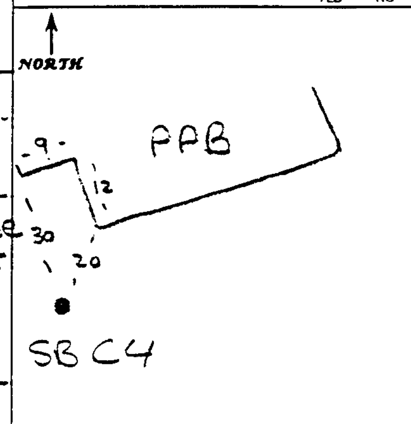
DATE 7-14-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 350 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELVEVATION

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	70	15	1	SM				SILTY SAND WITH GRAVEL- brown, slightly moist, medium dense to dense, fine grained sand, fine to coarse subrounded gravel, apparent fill, exhibits hydrocarbon odor
2	3						220	1630	■	
	15								■	
3	16								■	
	18								■	limestone rock fragments
5										Boring terminated at 4' Backfilled with bentonite/cuttings mixture No groundwater encountered
13										Bedrock (limestone) appears to be shallow at this site, from 4.5 to 8.5 feet below grade. The limestone is relatively soft, and allows the sampler (40+ blows) and the auger head to advance. In C-3 and C-4 the limestone cuttings were pulverized and dry.

WELL COMPLETED? YES ☐ NO ☒



LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB C4a	1 OF 1

PROJECT TIN CITY LRRS SITE C (ST 12a) CLIENT AFCEE GEOLOGIST John D

DATE 7-14-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

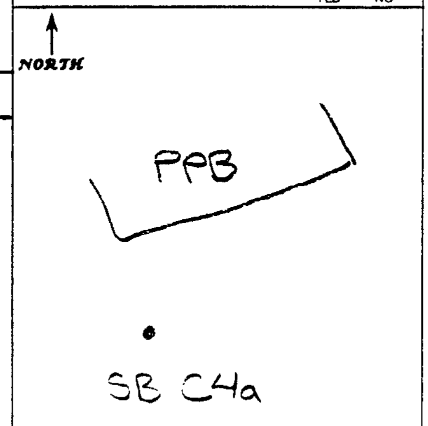
DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	70	15	1	SM				SILTY SAND WITH GRAVEL - brown, slightly moist, medium dense, fine-grained sand, some coarse-grained sand, fine to coarse subrounded gravel, apparent fill, exhibits hydrocarbon odor
4	8 40							1605		limestone - pulverized insufficient sample volume

Boring terminated at 6'
Backfilled with bentonite/cuttings mixture
Decide to step out (4'W) to resample
No groundwater encountered
No samples submitted to laboratory from this boring



LOCATION SKETCH

Exploratory Only

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB 01 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE D (ST 12b) CLIENT AFCEE GEOLOGIST John D.

DATE 7-17-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

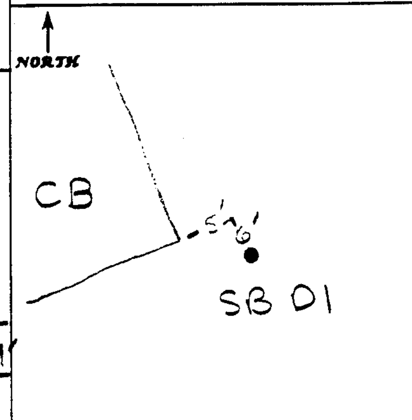
WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		35	55	10	3	SP-SM				POORLY GRADED SAND WITH SILT AND GRAVEL - dark brown, slightly moist, medium dense, fine-grained sand, some medium-grained sand, fine to coarse subrounded gravel, apparent fill, no odor limestone rock fragments at 4'
1	–						13	0930	■	
1.5	–									
3	50						42	1000	■	
3.5	80									

Boring terminated at 4' due to auger refusal.
Backfilled with bentonite/cuttings mixture
No groundwater encountered

Confident that the limestone rock fragments represent bedrock in this boring. Pulverized rock on drill bit. Fresh limestone cuts in the sampler.

Again, in some instances "auger refusal" means "sampler refusal". Augers may still advance with difficulty.



LOCATION SKETCH

DEPTH (FEET): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

JOB No. 0000.0000 Name: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB D2 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE D (ST 26) CLIENT AFCEE GEOLOGIST John D

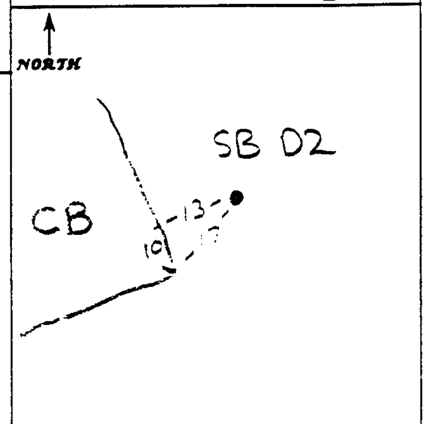
DATE 7-16-95 WEATHER Overcast - Fog LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		35	55	10	3	SP-SM				POORLY GRADED SAND WITH SILT AND GRAVEL - dark brown, slightly moist, medium dense, fine-grained sand, some medium-grained sand, fine to coarse sub-rounded gravel, apparent fill, apparent hydrocarbon odor, ripped (angular) rock fragments from 4 to 6', difficult drilling.
2	6						21	1830		
3	11									
3	15									
6										Boring terminated at 6'. Backfilled with bentonite/cuttings mixture. No groundwater encountered.

WELL COMPLETED? YES ☐ NO ☒



LOCATION SKETCH

JOB No. 0000.0000 time: 00-XXX-00 00:00 File: user name/project/file Name

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB D3	1 OF 1

PROJECT TIN CITY LRRS SITE D (ST 126) CLIENT AFCEE GEOLOGIST John D.

DATE 7-17-95 WEATHER Fog LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

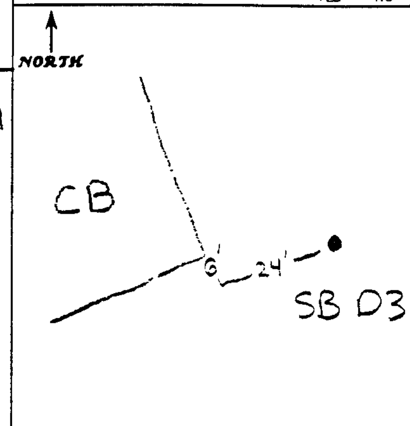
DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? ☐ YES ☒ NO

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SOIL DESCRIPTION (ASTM 2488)
0		35	55	10	3	SP-SM			POORLY GRADED SAND WITH SILT AND GRAVEL - dark
1	- -						28	1030	brown, slightly moist, medium dense, fine-grained sand, fine to coarse subrounded gravel, apparent fill, no odor, color
3	- - - -						57	1100	change to grey at 2'
5									color change to olive-green
6	25 50						24	1120	moisture change to moist
8	22 42 70							1145	pulverized and fragmented limestone (bedrock)

Boring terminated at 9.5'
Backfilled with bentonite/cuttings mixture
Groundwater encountered at approx. 8', suspected to be perched on top of bedrock. (g.w. few inches deep)



LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB E1	1 OF 1

PROJECT TIN CITY LRRS SITE E (SS14a) CLIENT AFCEE GEOLOGIST John D

DATE 7-15-95 WEATHER Sunny LOCATION COORDINATES ______ (Northing) ______ (Easting) ELEVATION DATUM ______ (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES ______ SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION ______

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		20	75	5	2	SP				POORLY GRADED SAND WITH GRAVEL - olive-green, slightly moist, medium dense, fine to medium grained sand, fine to coarse subrounded gravel, apparent fill, apparent hydrocarbon odor, limestone rock fragments at 2.5'
1	5						65	1335		
2	14									
	27									
3										
4										
5										Boring terminated at 4' due to auger refusal. Backfilled with bentonite/cuttings mixture. No groundwater encountered
6										
7										
8										
9										
10										
11										
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14										
15										
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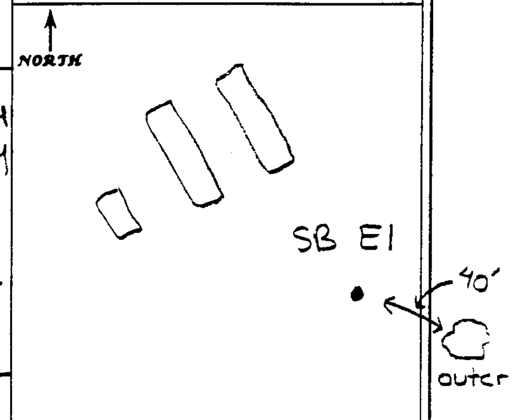
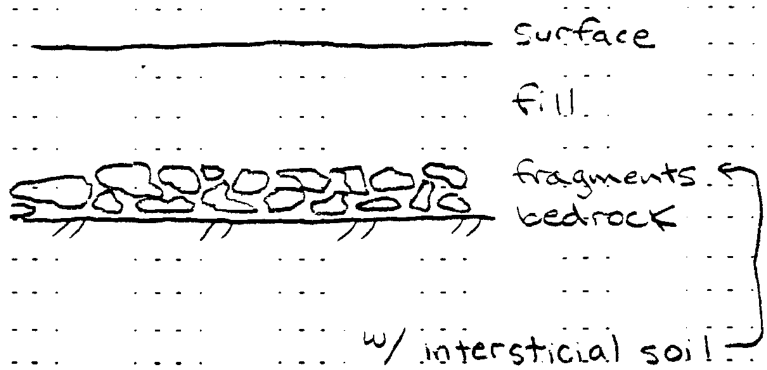
20										
21										



LOCATION SKETCH



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MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB E2 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE E (SS 14a) CLIENT AFCEE GEOLOGIST John D.

DATE 7-15-95 WEATHER Sunny LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

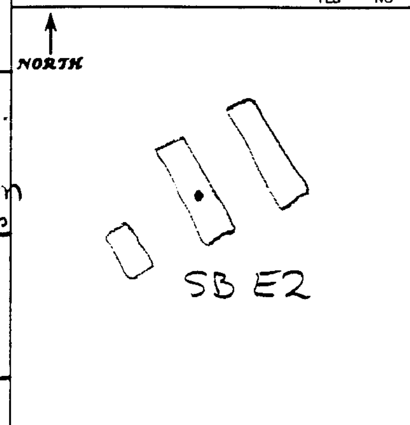
DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELVEVATION

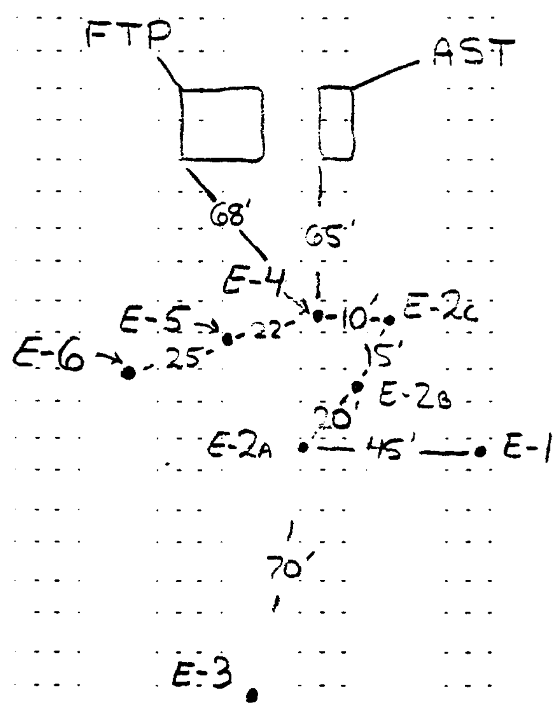
WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–4	7 / 23	15	70	15	1	Sm	32	1245		SILTY SAND WITH GRAVEL olive-green, slightly moist, medium dense, fine to medium grained sand, fine to coarse subrounded gravel, apparent fill, apparent hydrocarbon odor, limestone rock fragments at 3'

Boring terminated at 4'
due to auger refusal (pulverized limestone cuttings)
Backfilled with bentonite/cuttings mixture
No groundwater encountered



LOCATION SKETCH



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MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB E2a | SHEET 1 OF 1

PROJECT: TIN CITY LRRS | SITE: E (SS14a) | CLIENT: AFCEE | GEOLOGIST: John D

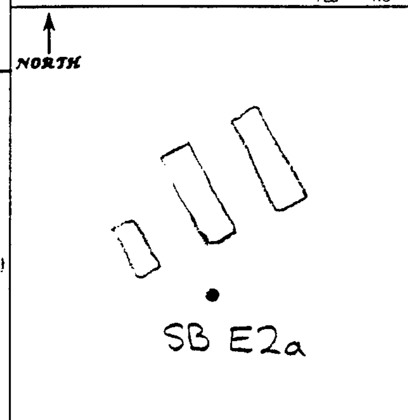
DATE: 7-15-95 | WEATHER: Sunny | LOCATION COORDINATES: (Northing) (Easting) | ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: HSA | BORING SIZE: 10 1/4" | HAMMER DROP (IN/LBS): 30/340 | RIG TYPE: CME 850 | DRILLER/COMPANY: USAF

SAMPLES: | SAMPLE TYPE: Split-spoon | SAMPLER TYPE/DIAMETER: 3" | TOTAL DEPTH (FT): see bottom of log | DEPTH TO SWL (FT): — | TOP OF HOLE ELEVATION:

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		20	60	20	1	SM				SILTY SAND WITH GRAVEL - olive-green, slightly moist, medium dense, fine-grained sand, fine to coarse sub-rounded gravel, apparent fill, apparent hydrocarbon odor
4										Limestone - pulverized cuttings



LOCATION SKETCH

Boring terminated at 5' due to auger refusal
Backfilled with bentonite/cuttings mixture.
Decide with Brett to move boring approx. 10'N and 10'E.
No groundwater encountered
No samples submitted to laboratory from this boring.

Limestone contains characteristic white calcite veins: Anhedral/Euhedral crystals.

Not certain of exact location of former USTs. Will step over borings in attempt to drill deeper than 4-5' before encountering bedrock

Exploratory Only

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB E2b

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE E (SS 14a) CLIENT AFCEE GEOLOGIST John O

DATE 7-15-95 WEATHER Sunny LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

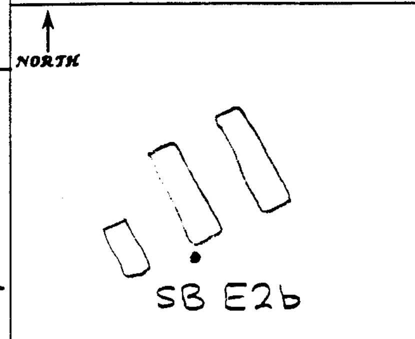
DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 85D DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	70	15	1	SM				SILTY SAND WITH GRAVEL: olive-green, slightly moist, medium dense, fine to medium grained sand, fine to coarse subrounded gravel, apparent fill, apparent hydrocarbon odor
4										Limestone - pulverized cuttings
6										Boring terminated at 4.5' due to auger refusal. Backfilled with bentonite/cuttings mixture. Decide with Brett to move hole approx 10'N-10'E. No groundwater encountered. No samples submitted to laboratory from this boring

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

WELL COMPLETED? YES ☐ NO ☒



LOCATION SKETCH

Exploratory Only

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020
BORING NO.: SB E3
SHEET 1 OF 1

PROJECT: TIN CITY LRRS   SITE: E (SS 14a)   CLIENT: AFCEE   GEOLOGIST: John D

DATE: 7-5-95   WEATHER: Sunny w/Fog   LOCATION COORDINATES: (Northing) (Easting)   ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: HSA   BORING SIZE: 10 1/4"   HAMMER DROP (IN/LBS): 30/340   RIG TYPE: CME 850   DRILLER/COMPANY: USAF

SAMPLES: SAMPLE TYPE: Split-spoon   SAMPLER TYPE/DIAMETER: 3"   TOTAL DEPTH (FT): see bottom of log   DEPTH TO SWL (FT): —   TOP OF HOLE ELEVATION:

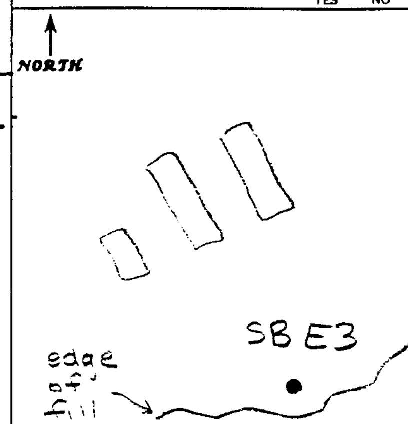
WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		30	55	15	2	SM				SILTY SAND WITH GRAVEL - olive-green, slightly moist, medium dense, fine-grained sand, some coarse-grained sand, fine to coarse sub-rounded gravel, apparent fill, no odor, cobbles.
6	3 / 5 / 23						64	0915		moisture change to very moist no odor. limestone rock fragments. difficult drilling
10	70 / 50						60	0950		frozen pore water limestone rock fragments

freeze-thaw

permafrost

Boring terminated at 12' due to permafrost
Backfilled with bentonite/cuttings mixture
No groundwater encountered



LOCATION SKETCH

JOB No. 0000.0000   Time: 00-XXX-00 00:00   File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB E4 | SHEET 1 OF 1

PROJECT: TIN CITY LRRS | SITE: E (SS 14a) | CLIENT: AFCEE | GEOLOGIST: John D

DATE: 7-15-95 | WEATHER: Sunny | LOCATION COORDINATES: (Northing) (Easting) | ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: HSA | BORING SIZE: 10¼" | HAMMER DROP (IN/LBS): 30/340 | RIG TYPE: CME 850 | DRILLER/COMPANY: USAF

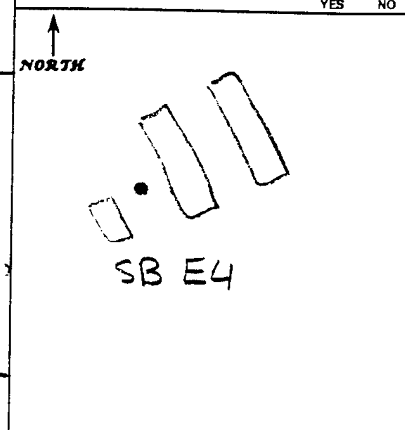
SAMPLES | SAMPLE TYPE: Split-spoon | SAMPLER TYPE/DIAMETER: 3" | TOTAL DEPTH (FT): see bottom of log | DEPTH TO SWL (FT): — | TOP OF HOLE ELEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–4	6 / 14 / 80	20	65	15	1	SM	260	1415	2–4	SILTY SAND WITH GRAVEL - olive-brown, slightly moist, medium dense, fine grained sand, fine to coarse sub-rounded gravel, apparent fill, apparent hydrocarbon odor, limestone rock fragments

Boring terminated at 4' due to auger refusal. Backfilled with bentonite/cuttings mixture. No groundwater encountered

Note: Tank locations in the E sketch are for imaginary reference only. Exact tank locations not certain. Locations estimated by USAF. E-4 approx 20' W of E-2c. E-5 approx 20' W of E-4



LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB ES | SHEET 1 OF 1

PROJECT: TIN CITY LRRS | SITE: E (SS 14a) | CLIENT: AFCEE | GEOLOGIST: John D

DATE: 7-15-95 | WEATHER: Sunny | LOCATION COORDINATES: (Northing) (Easting) | ELEVATION DATUM: (MSL/Other)

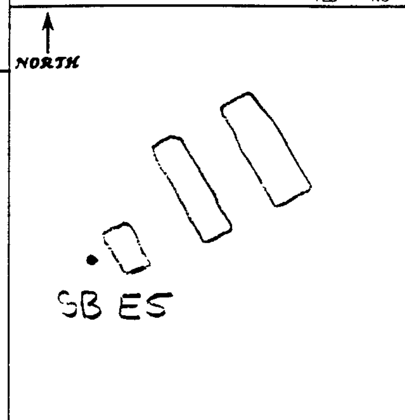
DRILLING METHOD: HSA | BORING SIZE: 10¼" | HAMMER DROP (IN/LBS): 30/340 | RIG TYPE: CME 850 | DRILLER/ COMPANY: USAF

SAMPLES | SAMPLE TYPE: Split-spoon | SAMPLER TYPE/DIAMETER: 3" | TOTAL DEPTH (FT): see bottom of log | DEPTH TO SWL (FT): — | TOP OF HOLE ELVEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–2		20	65	15	1	SM				SILTY SAND WITH GRAVEL - olive green, slightly moist, medium dense, fine grained sand, some medium-grained sand, fine to coarse sub-rounded gravel, apparent fill, apparent hydrocarbon odor, limestone rock fragments
2	2						77	1545		
2.5	14									
3	20									
4	50						79	1605		

Boring terminated at 5' due to auger refusal
Backfilled with bentonite / cuttings mixture
No groundwater encountered



LOCATION SKETCH

File: user name/project/File Name   Time: 00-XXX-00 00:00   JOB No. 0000.000u

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB E6

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE E (SS 14a) CLIENT AFCEE GEOLOGIST John D

DATE 7-15-95 WEATHER Sunny LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

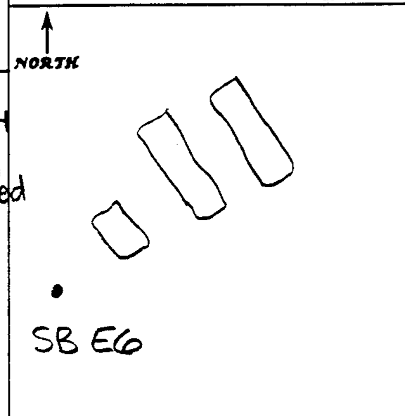
SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	80	5	1	SP				POORLY GRADED SAND WITH GRAVEL - light brown, slightly moist, medium dense, fine grained sand, some medium and coarse grained sand, fine to coarse subrounded gravel, apparent fill, apparent hydrocarbon odor
2	4						62	1625		
3	6									
	8									
	10									
4	50						15	1640		limestone

Boring terminated at 5' due to auger refusal
Backfilled with bentonite / cuttings mixture
No groundwater encountered

NORTH



SB E6

LOCATION SKETCH

JOB No. 0000.0 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB F1

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE F (SS 14b) CLIENT AFCEE GEOLOGIST John D.

DATE 7-16-95 WEATHER Fog - Wind LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0										(topsoil)
		10	70	20	1	SM				SILTY SAND, brown, moist, medium dense, fine grained
1	5						70	1430		sand, some medium-grained
	15									sand, fine to coarse sub-
2	20									rounded gravel, roots, no odor
									X	limestone rock fragments
3										
										difficult drilling
4	8						110	1445		limestone rock fragments,
	22									interstitial soil
5	70									
									X	
6										
7										Boring terminated at 6' due to auger refusal
										Backfilled with bentonite/cuttings mixture
8										No groundwater encountered
9										
10										
11										
12										
13										
14										
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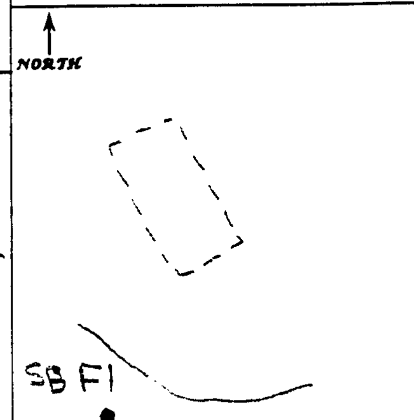
16										
17										
18										
19										
20										
21										



LOCATION SKETCH

JOB No. 0000.0000 time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020
BORING NO.: SB F2
SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE F (SS 146) CLIENT AFCEE GEOLOGIST

DATE 7-15-95 WEATHER Sunny LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	80	5	1	SP				POORLY GRADED SAND WITH GRAVEL - brown, slightly moist, fine grained sand, some medium and coarse-grained sand, fine to coarse subrounded gravel, apparent fill, no odor.
2	6						7	1800		
3	6									
	8									
4	12									
	7						8	1815		moisture change to moist frozen - permafrost.
5	26									
	70								X	

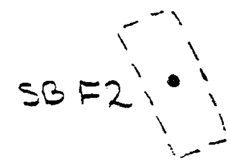
Boring terminated at 6' due to auger refusal
Backfilled with bentonite/cuttings mixture
No groundwater encountered.

No limestone encountered as this boring location is higher up on a mound.

12 ■ Sample for that 6" interval retrieved showing blow counts.

X No recovery. (To avoid some confusion as with F-4, not all trailing X's have to be illustrated).

NORTH



LOCATION SKETCH

JOB No. 0000.0... Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB F3	1 OF 1

PROJECT TIN CITY LRRS SITE F (SS 14b) CLIENT AFCEE GEOLOGIST John D

DATE 7-16-95 WEATHER Fog LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

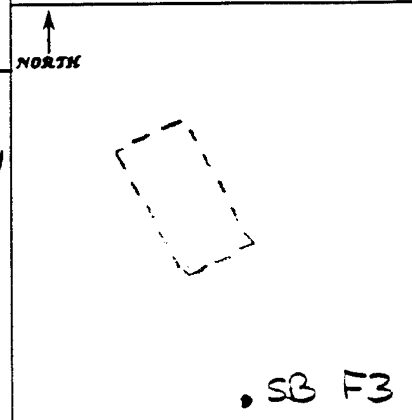
DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 2" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

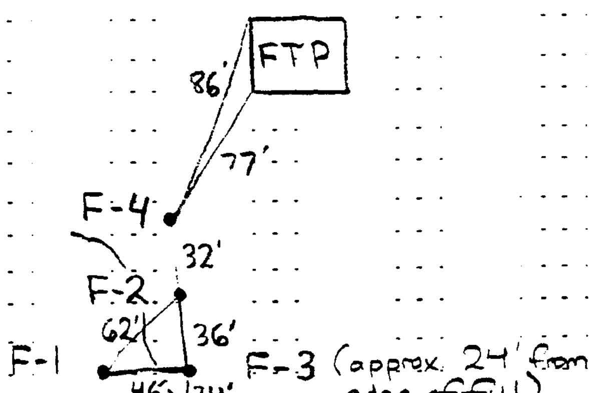
WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–2		20	75	5	2	SP				POORLY GRADED SAND WITH GRAVEL - light brown, slightly moist, loose, fine-grained sand, some medium-grained sand, fine to coarse subrounded gravel, apparent fill, no odor
2–4	2, 2, 5, 2						17	1140	2–4	
5		15	65	20	1					SILTY SAND WITH GRAVEL light brown, moist, dense, fine to medium grained sand, fine to coarse subangular gravel, apparent fill, apparent hydrocarbon (gasoline) odor color change to olive-green (stained)
6–7.5	14, 46, 56						>2500	1300	6–7.5 X	
10	100						330	1330	X	boulder - drill through cobbles - no recovery

Boring terminated at 10.5'
Backfilled with bentonite/cuttings mixture
No groundwater encountered



LOCATION SKETCH



JOB No. 0000.0. Time: 00-XXX-00 00:00 File: user name/project/File Name

SOIL BORING LOG

MONTGOMERY WATSON

PROJECT NO.: 3380.0020 | BORING NO.: SB F4 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE F (SS14b) CLIENT AFCEE GEOLOGIST John O

DATE 7-15-95 WEATHER Sunny LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD 7-16-95 HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	SOIL DESCRIPTION (ASTM 2488)
0		10	80	10	1	SP-SM			POORLY GRADED SAND WITH SILT - brown, slightly moist, medium dense, fine grained sand, some medium grained sand,
2	2, 3, 3, 6						17	1835	fine to coarse subrounded gravel, apparent fill, wood fragments, no odor, color change to olive green at 2'.
4	7, 30, 70						17	1850	moisture change to moist frozen 6" limestone rock fragments - intersticial soil unfrozen.
6	22, 75						6	1910	↓
8		10	70	20	.5	SM			SILTY SAND - light brown, slightly moist, dense, fine-grained sand, some medium and coarse grained sand, fine subrounded gravel, apparent fill, no odor.
10	50						21	1950	apparent paint thinner odor. limestone rock fragment - try to overdrill, re-sample
11	24, 200						1330	2010	limestone rock fragments - intersticial soil - apparent paint thinner odor. consistency change to very dense
13								7-16 cont	
14									difficult advancement - smooth spin. cuttings appear pulverized - but not of rock, of hard soil
16	70, 100+						8	0945	limestone rock fragments - intersticial soil apparent paint thinner odor - moist
18									Boring terminated at 17'. Backfilled with bentonite/cuttings mixture. No groundwater encountered
20									Limestone "rock fragments" are cobble-size and up.

NORTH

SB F4

LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB G1 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE G (SS 13a) CLIENT AFCEE GEOLOGIST John D

DATE 7-11-95 WEATHER Overcast - Fog LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) RIG TYPE DRILLER/COMPANY

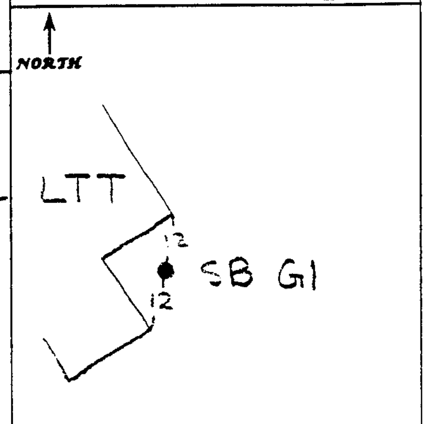
SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		40	58	2	5	SW		1100	■	WELL GRADED SAND WITH GRAVEL - stained olive-brown 0-0.5', color change to light brown at 0.5', moist, medium dense, fine to coarse-grained sand, fine to coarse sub-angular gravel, subangular cobbles, apparent fill, apparent hydrocarbon odor

Boring terminated at 1'
Backfilled with bentonite/cuttings mixture.
No groundwater encountered.

HA refusal - Rig access denied



LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB G2

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE G (SS 13a) CLIENT AFCEE GEOLOGIST John D.

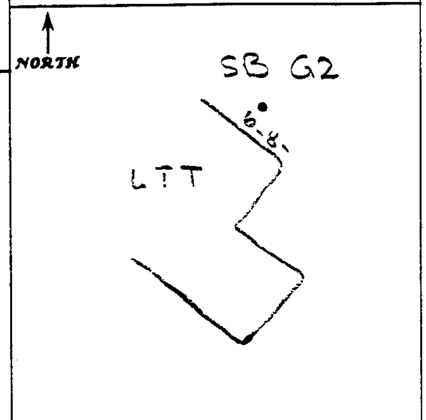
DATE 7-17-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 0 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) – TOP OF HOLE ELEVATION

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		20	70	10	2	SP-SM				POORLY GRADED SAND WITH SILT AND GRAVEL- dark brown, moist, loose, fine-grained sand, some medium and coarse grained sand, fine to coarse subrounded gravel, apparent fill, apparent hydrocarbon odor, limestone bedrock at 2.5'
1	3 3 3						306	1800		
2	5 50									
3										

WELL COMPLETED? YES [ ] NO [X]



LOCATION SKETCH

Boring terminated at 3'
Backfilled with bentonite/cuttings mixture
No groundwater encountered

File: user name/project/File Name Time: 00-XXX-00 00:00 JOB No. 0000.0000

SOIL BORING LOG

MONTGOMERY WATSON

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB G3	1 OF 1

PROJECT: TIN CITY LRRS SITE: G (SS 13a) CLIENT: AFCEE GEOLOGIST: John D

DATE: 7-17-95 WEATHER: Foggy LOCATION COORDINATES: (Northing) (Easting) ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: HSA BORING SIZE: 10¼" HAMMER DROP (IN/LBS): 30/340 RIG TYPE: CME 850 DRILLER/COMPANY: USAF

SAMPLES SAMPLE TYPE: Split-spoon SAMPLER TYPE/DIAMETER: 3" TOTAL DEPTH (FT): see bottom of log DEPTH TO SWL (FT): — TOP OF HOLE ELEVATION

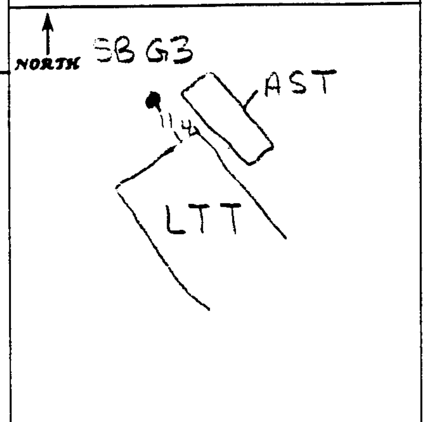
WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	80	5	2	SP				POORLY GRADED SAND WITH GRAVEL - olive - green, moist, loose, fine to medium-grained sand, fine to coarse rounded gravel, apparent fill, apparent hydrocarbon odor, apparent staining
1	2						489	1430		
2	4, 4									
3	8									
4	50							1450		difficult drilling - limestone rock fragments
5										

Boring terminated at 5' due to auger refusal. Backfilled with bentonite/cuttings mixture. No groundwater encountered.

Rounded and subrounded gravel may indicate terrace deposits.

Shallow bedrock suspected in this area



LOCATION SKETCH

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB G4

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE G (SS13a) CLIENT AFCEE GEOLOGIST John D

DATE 7-17-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

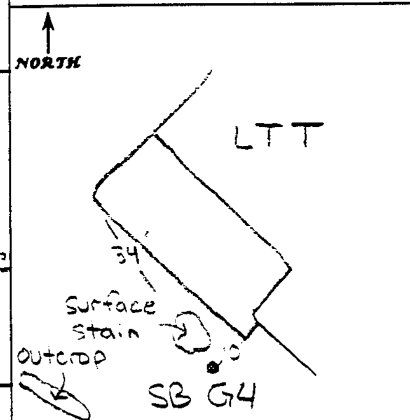
DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	80	5	3	SP				POORLY GRADED SAND WITH Gravel - brown, moist, med. dense, fine grained sand, some medium and coarse grained sand, fine to coarse subrounded gravel, apparent fill, no odor, limestone bedrock at 2'.
1	3						22	1600		
	7									
2	50									

LOCATION SKETCH



Boring terminated at 2'.
Backfilled with bentonite / cuttings mixture
No groundwater encountered.

Bedrock in sampler in this boring exhibits a calcite crystal surface evident on the outcrop nearby. See photos. Same for G-7.

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MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020

BORING NO.: SB G5

SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE G (SS 13a) CLIENT AFCEE GEOLOGIST John D

DATE 7-11-95 WEATHER Overcast - Fog LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

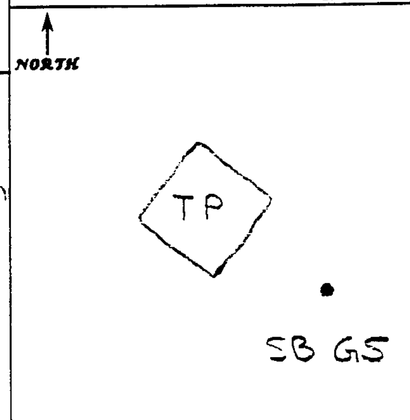
DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–3		10	80	10	2	SP-SM		1150	■ (approx. 2.5–3 ft)	POORLY GRADED SAND WITH SILT - brown, moist, medium dense, fine to medium grained sand, some coarse-grained sand, fine to coarse angular gravel, apparent fill material

Boring terminated at 3' due to auger refusal.
Backfilled with bentonite/cuttings mixture.
No odors by olfactory
No groundwater encountered



LOCATION SKETCH

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB G6	1 OF 1

PROJECT TIN CITY LRRS SITE G (SS 13a) CLIENT AFCEE GEOLOGIST John D

DATE 7-17-95 WEATHER Fog LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	80	5	3	SP				POORLY GRADED SAND WITH GRAVEL - brown, moist, med.-dense, fine-grained sand, some medium and coarse grained sand, fine to coarse sub-rounded gravel, apparent fill, no odor.
1	3						21	1530		
	3									
2	6									
	3									
3	8									
	22							1545		
4	50									limestone rock
5										
6										
7										
8										
9										
10										
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12										
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18										
19										
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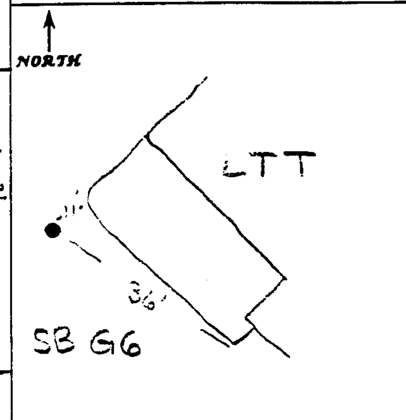
21										



LOCATION SKETCH

Boring terminated at 4' due to auger refusal (bedrock)
Backfilled with bentonite/cuttings mixture
No groundwater encountered

MONTGOMERY WATSON
Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB G7 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE G (SS 13a) CLIENT AFCEE GEOLOGIST John D

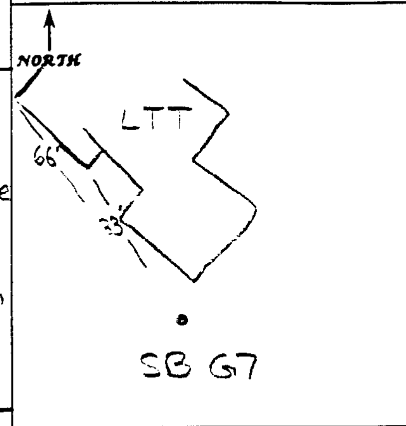
DATE 7-17-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10¼" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) TOP OF HOLE ELEVATION

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		15	80	5	3	SP				POORLY GRADED SAND WITH
1	3						24	1610		GRAVEL - dark brown, moist,
	4									loose, fine-grained sand, some
2	5									medium and coarse-grained
	5									sand, fine to coarse sub-
3	5							1620		rounded gravel, apparent fill,
	5									no odor
4	8									limestone bedrock
	30									
5										
6										Boring terminated at 4.5' Backfilled with bentonite/cuttings mixture
7										No groundwater encountered
8										
9										Split the shoe - stress defect - see photo
10										
11										
12										
13										
14										
15										
16										In many cases you have written subrounded
17										gravel, but you really have subangular,
										subrounded and rounded gravels in many
18										locations.
19										
20										
21										

WELL COMPLETED? YES NO



LOCATION SKETCH

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MONTGOMERY WATSON Anchorage, Alaska

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB G8	1 OF 1

PROJECT TIN CITY LRRS SITE G (SS 13a) CLIENT AFCEE GEOLOGIST John D.

DATE 7-17-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/ COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		20	70	10	3	SP-SM				POORLY GRADED SAND WITH SILT AND GRAVEL - brown, moist, loose, fine-grained sand some medium and coarse-grained sand, fine to coarse subrounded gravel, apparent fill, apparent hydrocarbon odor, limestone bedrock at 3'
1	3						219	1820		
	4									
2	5									
	7									
3	10						169	1830		
	50									
4										
5										Boring terminated at 3.5' Backfilled with bentonite / cuttings mixture No groundwater encountered
6										
7										
8										
9										
10										
11										
12										
13										
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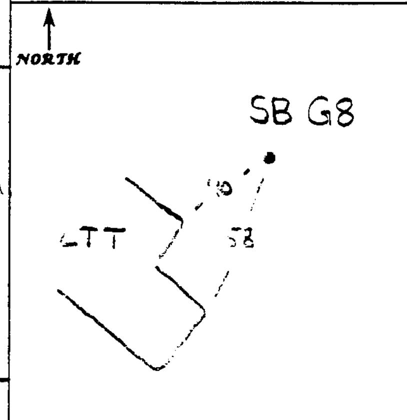
16										
17										
18										
19										
20										
21										

WELL COMPLETED? YES ☐ NO ☒



LOCATION SKETCH

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB J1 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE J (ST 12c) CLIENT AFCEE GEOLOGIST John D.

DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

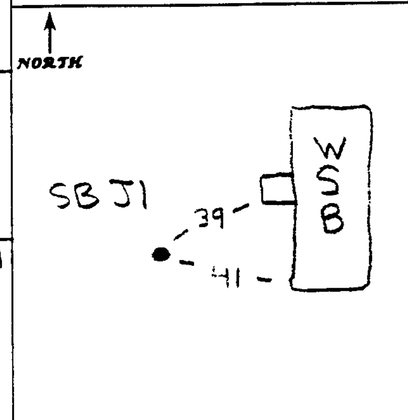
DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) 0.8 TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–1		100	0	0	2	GW				POORLY GRADED GRAVEL - grey, very moist, loose, 1 to 2" subangular coarse gravel, apparent fill.
1		30	60	10	2	SP-SM		1340	■	POORLY GRADED SAND WITH SILT AND GRAVEL - dark brown, very moist to saturated at 0.8', medium dense, fine to medium-grained sand, fine to coarse angular gravel, seepage in hole at 0.8', no product sheen, apparent fill.

Boring terminated at 1.0'.
Groundwater encountered at 0.8'.
Backfilled with bentonite/cuttings mixture
Soil odorous by olfactory at 0.6'



LOCATION SKETCH

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB J2	1 OF 1

PROJECT TIN CITY LRRS SITE J (ST 12c) CLIENT AFCEE GEOLOGIST John D.

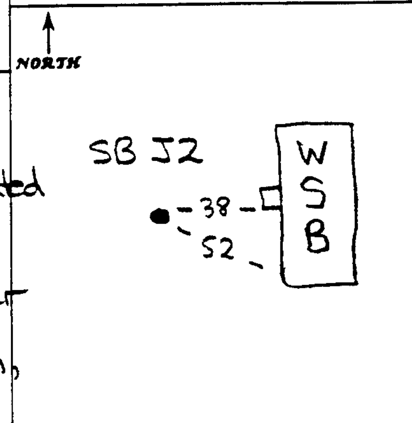
DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES (Northing) — (Easting) — ELEVATION DATUM (MSL/Other)

DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) 0.3 TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		30	60	10	2	SP-SM		1400		POORLY GRADED SAND WITH SILT and GRAVEL - dark brown, very moist to saturated at 0.3', medium dense, fine to medium-grained sand, fine to coarse angular gravel, seepage in hole at 0.3', no product sheen, apparent fill



LOCATION SKETCH

Boring terminated at 0.5'
Groundwater encountered at 0.3'
Backfilled with bentonite / cuttings mixture
Soil odorous by olfactory at 0.2'

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SOIL BORING LOG

MONTGOMERY WATSON

PROJECT NO.: 3380.0020 | BORING NO.: SB J3 | SHEET 1 OF 1

PROJECT TIN CITY LRRS SITE J (ST 12c) CLIENT AFCEE GEOLOGIST John D

DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

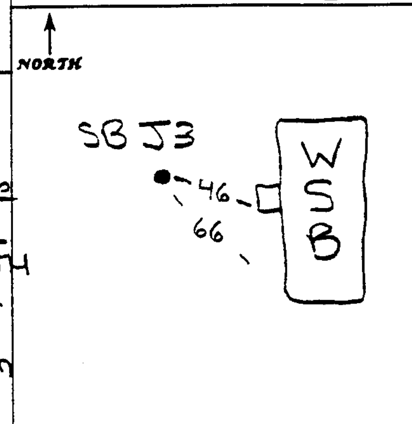
SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) 0.6 TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–0.6		100	0	0	2	GW				POORLY GRADED GRAVEL - grey, very moist, loose, 1 to 2" subangular coarse gravel, apparent fill
0.6–1.0		30	60	10	2	SP-SM		1410	■	POORLY GRADED SAND WITH SILT AND GRAVEL - dark brown, very moist to saturated at 0.6', medium dense, fine to medium-grained sand, fine to coarse angular gravel, seepage in hole at 0.6', no product sheen, apparent fill

Boring terminated at 1.0'
Groundwater encountered at 0.6'
Backfilled with bentonite/cuttings mixture
Soil odorous by olfactory at 0.4'

LOCATION SKETCH



Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

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SOIL BORING LOG

MONTGOMERY WATSON Anchorage, Alaska

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB J4	1 OF 1

PROJECT TIN CITY LRRS SITE J (ST12c) CLIENT AFCEE GEOLOGIST John D

DATE 7-18-95 WEATHER Fog LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

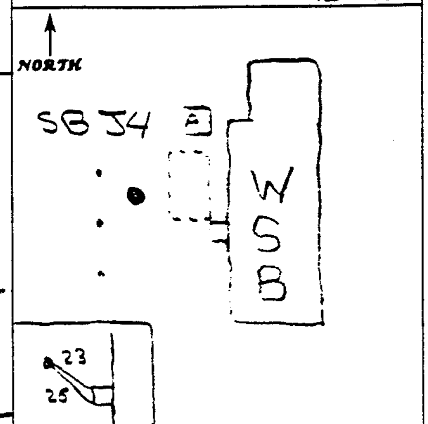
DRILLING METHOD HSA BORING SIZE 10 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 850 DRILLER/COMPANY USAF

SAMPLES SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 3" TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) — TOP OF HOLE ELEVATION

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		40	50	10	3	SP-SM				POORLY GRADED SAND WITH SILT AND GRAVEL dark grey, moist, loose, fine grained sand, some coarse grained sand, fine to coarse angular gravel, apparent fill, apparent hydrocarbon odor, 6" gravel layer from 3.5 to 4.0
1	2, 3						380	1130		
2	4, 3									
3	6, 8						368	1145		
4	12, 35									

Boring terminated at 4.5'
Backfilled with bentonite /cuttings mixture
Groundwater encountered at approx 4.0'

WELL COMPLETED? YES [ ] NO [X]



LOCATION SKETCH

Depth scale 0–21 feet.

File: user name/project/File Name Time: 00-XXX-00 00:00 JOB No. 0000.0000

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB J5	1 OF 1

PROJECT: TIN CITY LRRS   SITE: J (ST 12c)   CLIENT: AFCEE   GEOLOGIST: John D

DATE: 7-18-95   WEATHER: Overcast - Fog   LOCATION COORDINATES: (Northing) (Easting)   ELEVATION DATUM: (MSL/Other)

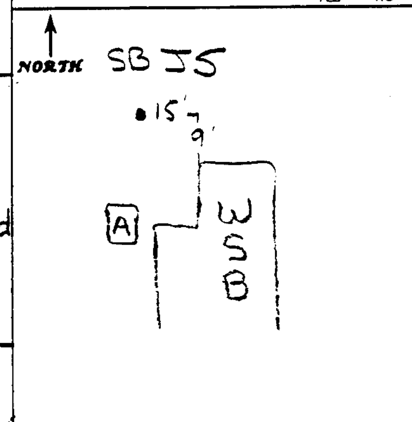
DRILLING METHOD: HSA   BORING SIZE: 10 1/4"   HAMMER DROP (IN/LBS): 30/340   RIG TYPE: CME 850   DRILLER/COMPANY: USAF

SAMPLES: SAMPLE TYPE: Split-spoon   SAMPLER TYPE/DIAMETER: 3"   TOTAL DEPTH (FT): see bottom of log   DEPTH TO SWL (FT): —   TOP OF HOLE ELEVATION:

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		35	60	5	2	SP-SM				POORLY GRADED SAND WITH SILT AND GRAVEL - brown, moist to very moist above 3.5, loose, fine-grained sand, fine to coarse angular gravel, apparent fill, apparent sewage odor
1	3						21	1035		
	4									
2	2									
	3									
3	3						175	1045		
	4									
4	9	35	50	15	2	SM				SILTY SAND WITH GRAVEL - olive green, moist (in layers with silt/sand/gravel) saturated (in layers with increased gravel), dense, fine grained sand, some coarse-grained sand, fine to coarse angular gravel (some rounded gravel), apparent fill, apparent sewage odor
	20									
5	18							1055		
	26									
6	48									

Boring terminated at 6.5'
Backfilled with bentonite/cuttings mixture
Groundwater encountered at approx. 3.5'



LOCATION SKETCH

JOB No. 0000.0   Time: 00-XXX-00 00:00   File: user name/project/File Name

SOIL BORING LOG

MONTGOMERY WATSON, Anchorage, Alaska

PROJECT NO.: 3380.0020 | BORING NO.: SB J6 | SHEET 1 OF 1

PROJECT: TIN CITY LRRS | SITE: J (ST12c) | CLIENT: AFCEE | GEOLOGIST: John D

DATE: 7-18-95 | WEATHER: Overcast | LOCATION COORDINATES: (Northing) (Easting) | ELEVATION DATUM: (MSL/Other)

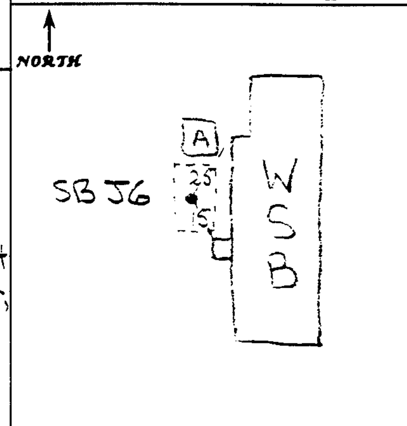
DRILLING METHOD: HSA | BORING SIZE: 10¼" | HAMMER DROP (IN/LBS): 30/340 | RIG TYPE: CME 850 | DRILLER/COMPANY: USAF

SAMPLES | SAMPLE TYPE: Split-spoon | SAMPLER TYPE/DIAMETER: 3" | TOTAL DEPTH (FT): see bottom of log | DEPTH TO SWL (FT): — | TOP OF HOLE ELEVATION

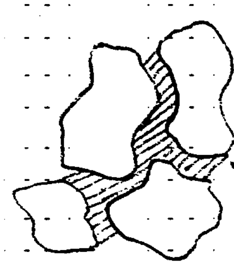
DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		50	40	10	2	GP-GM				POORLY GRADED GRAVEL WITH SILT AND SAND: olive green, moist, loose, fine-grained sand, fine to coarse angular gravel, apparent fill, apparent hydrocarbon odor, - moisture change to very moist - consistency change to very dense, with frozen pore water
1	2, 1, 1, 1						880	1255		
3	3, 12, 35, 35						1510	1300		
5	33, 37, 50						218	1310		
6–21										

Boring terminated at 6'
Backfilled with bentonite/cuttings mixture
No groundwater encountered

WELL COMPLETED? YES ☐ NO ☒



LOCATION SKETCH



Frozen Pore Water (Actual size)

Frozen Pore Water (Actual size)

JOB No. 0000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.: 3380.0020 | BORING NO.: SB J7 | SHEET 1 OF 1

PROJECT: TIN CITY LRRS | SITE: J (ST-12c) | CLIENT: AFCEE | GEOLOGIST: John D

DATE: 7-18-95 | WEATHER: Overcast | LOCATION COORDINATES: (Northing) (Easting) | ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: HSA | BORING SIZE: 10¼" | HAMMER DROP (IN/LBS): 30/340 | RIG TYPE: CME 850 | DRILLER/COMPANY: USAF

SAMPLES | SAMPLE TYPE: Split-spoon | SAMPLER TYPE/DIAMETER: 2" | TOTAL DEPTH (FT): see bottom of log | DEPTH TO SWL (FT): – | TOP OF HOLE ELVEVATION

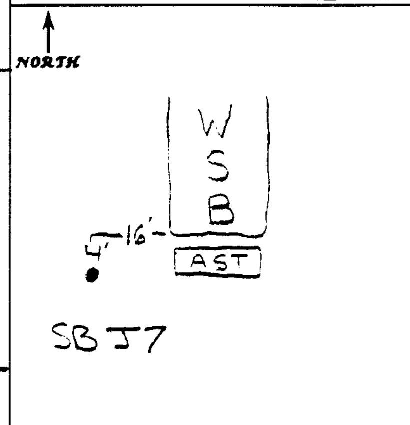
WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	TIME	SOIL DESCRIPTION (ASTM 2488)
0–4	5, 5, 5, 7, 5, 5, 5, 7	40	50	10	2	SP-SM	50; 55	1430; 1440	POORLY GRADED SAND WITH SILT AND GRAVEL - brown, moist, medium dense, fine-grained sand, fine to coarse subangular gravel, apparent fill, apparent hydrocarbon odor, color change to olive-green at 2'
4–6	24, 35, 50	50	40	10	3	GP-GM	124	1450	POORLY GRADED GRAVEL WITH SILT AND SAND - dark grey, very moist, very dense, fine-grained sand, fine to coarse subangular gravel, apparent fill, apparent hydrocarbon odor, frozen pore water

Boring terminated at 6'
Backfilled with bentonite/cuttings mixture
No groundwater encountered

Zones of frozen pore water likely to represent freeze-thaw zones.

Freeze-thaw zones do not always lie above permafrost; they may stand alone.



LOCATION SKETCH

JOB No. 000.0000 Time: 00-XXX-00 00:00 File: user name/project/File Name

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB J8	1 OF 1

PROJECT TIN CITY LRRS SITE J (ST 12c) CLIENT AFCEE GEOLOGIST John D.

DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

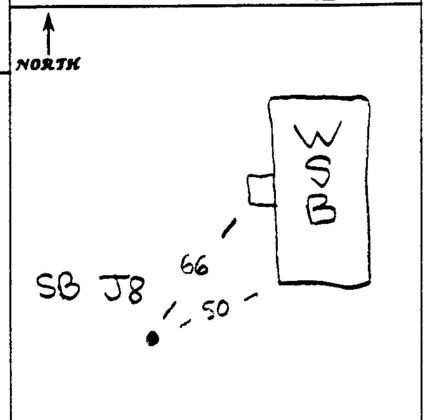
DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) 0.3 TOP OF HOLE ELEVATION

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		65	25	10	3	GW-GM		1420	■	WELL GRADED GRAVEL WITH SILT AND SAND - grey, very moist to saturated at 0.3', medium dense, fine to coarse grained sand, fine to coarse subangular gravel, seepage in hole at 0.3', no product sheen, apparent fill

Boring terminated at 0.5'
Groundwater encountered at 0.3'
Backfilled with bentonite/cuttings mixture
No odors by olfactory



LOCATION SKETCH

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SOIL BORING LOG

MONTGOMERY WATSON

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB J9	1 OF 1

PROJECT: TIN CITY LRRS SITE: J (ST 12c) CLIENT: AFCEE GEOLOGIST: John D.

DATE: 7-11-95 WEATHER: Overcast LOCATION COORDINATES: (Northing) (Easting) ELEVATION DATUM: (MSL/Other)

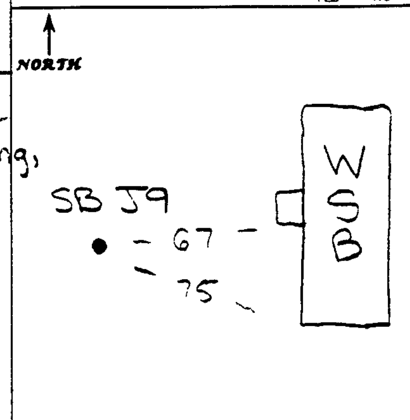
DRILLING METHOD: ~~HSA~~ HA BORING SIZE: 4" HAMMER DROP (IN/LBS): — RIG TYPE: — DRILLER/COMPANY: MW

SAMPLES: 1 SAMPLE TYPE: Split-spoon SAMPLER TYPE/DIAMETER: Grab TOTAL DEPTH (FT): see bottom of log DEPTH TO SWL (FT): 0.4 TOP OF HOLE ELEVATION:

WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		25	65	15	2	SM		1430	■	SILTY SAND WITH GRAVEL- dark brown with black staining, very moist to saturated at 0.4', medium dense, fine to medium-grained sand, fine to coarse subangular gravel, seepage in hole at 0.4', product sheen on groundwater surface, apparent fill

Boring terminated at 0.5'
Groundwater encountered at 0.4'
Backfiled with bentonite/cuttings mixture
Soil odorous by olfactory at 0.3'



LOCATION SKETCH

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Time: 00-XXX-00 00:00
JOB No. 0000.0000

MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB J10	1 OF 1

PROJECT TIN CITY LRRS SITE J (ST 12c) CLIENT AFCEE GEOLOGIST John D.

DATE 7-11-95 WEATHER Overcast LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD ~~HSA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/COMPANY MW

SAMPLES | SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) 1.0 TOP OF HOLE ELEVATION

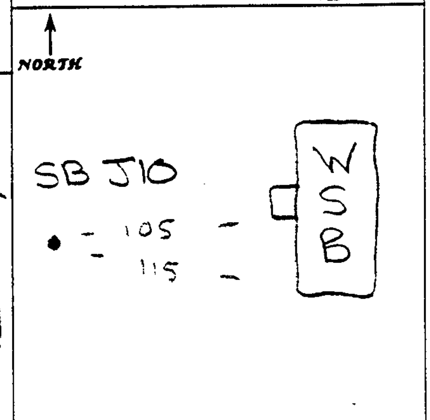
WELL COMPLETED? YES ☐ NO ☒

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0–3		10	40	50	1	ML		1515	■	SANDY SILT - grey, very moist to saturated at 1.0', soft, fine to medium-grained sand, fine to coarse sub-angular gravel, seepage in hole at 1.0', no product sheen, apparent native soil

Boring terminated at 1.0'
Groundwater encountered at 1.0'
Backfilled with bentonite/cuttings mixture
No odors by olfactory

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

LOCATION SKETCH



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MONTGOMERY WATSON

SOIL BORING LOG

PROJECT NO.:	BORING NO.:	SHEET
3380.0020	SB K1	1 OF 1

PROJECT TIN CITY LRRS SITE K (background) CLIENT AFCEE GEOLOGIST John D

DATE 7-11-95 WEATHER Overcast - foggy LOCATION COORDINATES (Northing) (Easting) ELEVATION DATUM (MSL/Other)

DRILLING METHOD ~~USA~~ HA BORING SIZE 4" HAMMER DROP (IN/LBS) — RIG TYPE — DRILLER/ COMPANY MW

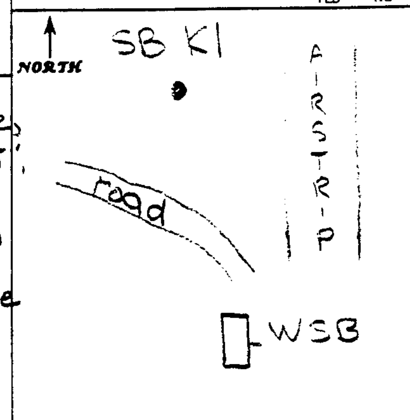
SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER Grab TOTAL DEPTH (FT) see bottom of log DEPTH TO SWL (FT) 0.5 TOP OF HOLE ELEVATION

WELL COMPLETED? YES [ ] NO [X]

DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL	SOIL DESCRIPTION (ASTM 2488)
0		10	85	5	3	SP		1445	■	POORLY GRADED SAND - grey blue, very moist to saturated at 0.5', medium dense, fine grained sand, coarse angular gravel, seepage in hole at 0.5', no product sheen, apparent native soil

Boring terminated at 0.7'
Groundwater encountered at 0.5'
Backfilled with bentonite/cuttings mixture
No odors by olfactory
No samples submitted to laboratory from this boring

Discounted From Investigation



LOCATION SKETCH

File: user name/project/File Name Time: 00-XXX-00 00:00 JOB No. 0000.0000

SOIL BORING LOG

MONTGOMERY WATSON Anchorage, Alaska

PROJECT NO.: 3380.0020
BORING NO.: SB K2
SHEET 1 OF 1

PROJECT: TIN CITY LRRS
SITE: K (background)
CLIENT: AFCEE
GEOLOGIST: John D

DATE: 7-18-95
WEATHER: Overcast
LOCATION COORDINATES: (Northing) (Easting)
ELEVATION DATUM: (MSL/Other)

DRILLING METHOD: HSA
BORING SIZE: 10¼"
HAMMER DROP (IN/LBS): 30/340
RIG TYPE: CME 850
DRILLER/COMPANY: USAF

SAMPLES:
SAMPLE TYPE: Split-spoon
SAMPLER TYPE/DIAMETER: 3"
TOTAL DEPTH (FT): see bottom of log
DEPTH TO SWL (FT): —
TOP OF HOLE ELEVATION:

WELL COMPLETED? YES ☐ NO ☒

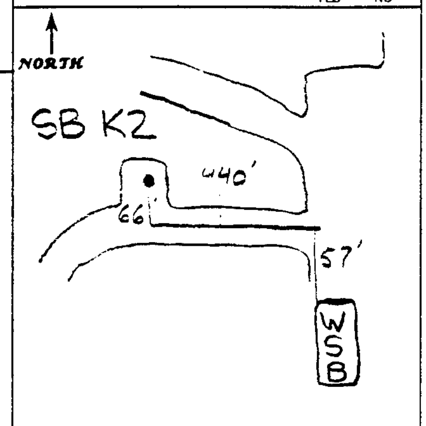
DEPTH (FEET)	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES	MAX SIZE (IN)	SOIL CLASS	PID (PPM)	SAMPLE TIME	SAMPLE INTERVAL
0		25	60	15	3	SM			
	4							1640	
1	3								
	3								
2	4								
	6							1650	
3	22								
	60								
4									

SOIL DESCRIPTION
(ASTM 2488)

SILTY SAND WITH GRAVEL - brown, slightly moist, loose, fine-grained sand, fine to coarse angular gravel (limestone and granite gravel), apparent fill, no odor, color change to light brown at 2', granite gravels are weathered to give a yellow color, some frozen pore water at 4'.

Boring terminated at 4' due to auger refusal.
Backfilled with bentonite / cuttings mixture.
No groundwater encountered.
No samples submitted to laboratory from this boring.

Discounted from Investigation



LOCATION SKETCH

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